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U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities

Americans are more worried than enthusiastic about using gene editing, brain chip implants and synthetic blood to change human capabilities

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Table of Contents

Overview	3
1. Understanding patterns in Americans' reactions to gene editing, brain chip implants and synthetic blood transfusions that push boundaries of the human condition	11
2. U.S. public opinion on the future use of gene editing	33
3. Public opinion on the future use of brain implants	53
4. The public's views on the future use of synthetic blood substitutes	69
5. From plastic surgery to vasectomies: Public opinion on current human enhancement options	86
6. Public sees science and technology as net positives for society	97
About this report	101
Acknowledgments	102
Methodology	104
Survey questionnaire and topline	109

U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities

Americans are more worried than enthusiastic about using gene editing, brain chip implants and synthetic blood to change human capabilities

Cutting-edge biomedical technologies that could push the boundaries of human abilities may soon be available, making people’s minds sharper and their bodies stronger and healthier than ever before. But a new Pew Research Center survey of U.S. adults shows that majorities greet the possibility of these

breakthroughs with more wariness and worry than enthusiasm and hope.

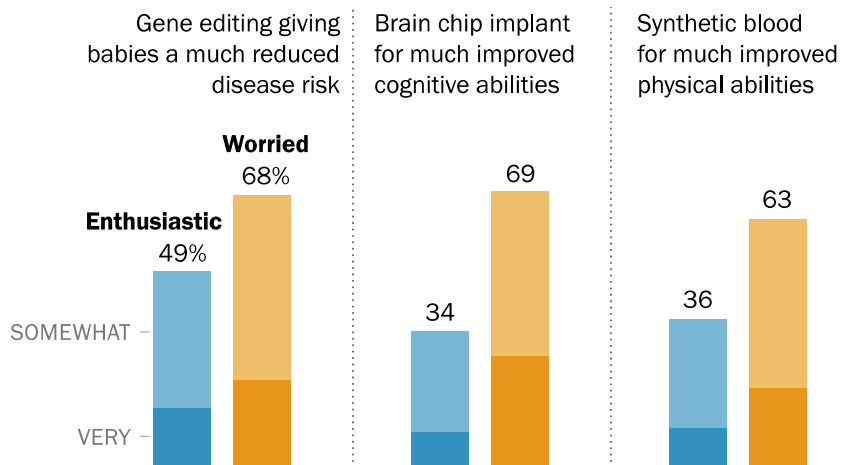
Many in the general public expect continued scientific and technological innovation, broadly speaking, to bring helpful change to society. Yet when people are queried about the potential use of emerging technologies for “human enhancement,” their attitudes are not nearly as affirming.

The survey examines public attitudes about the potential use of three emerging technologies that could fundamentally improve

people’s health, cognitive abilities or physical capacities. The specific examples were: gene editing to give babies a lifetime with much [reduced risk of serious disease](#), implanting brain chips to give people [a much improved ability to concentrate and process information](#) and transfusing of synthetic blood to give people [much greater speed, strength and stamina](#). These are just three of many enhancements that scientists and bioethicists say could arise from biomedical technologies

Public expresses more worry than enthusiasm about each of these potential human enhancements

% of U.S. adults who say they are _____ about each of these enhancements



Note: Respondents who gave other responses or who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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now under development. None of the three are currently available for the purpose of enhancing otherwise healthy babies or adults, though all are in a research and development phase or are being tested in very limited circumstances for therapeutic uses, such as helping patients to recover from a stroke or spinal cord injury. (For background see “[Human Enhancement: The Scientific and Ethical Dimensions of Striving for Perfection](#).”)

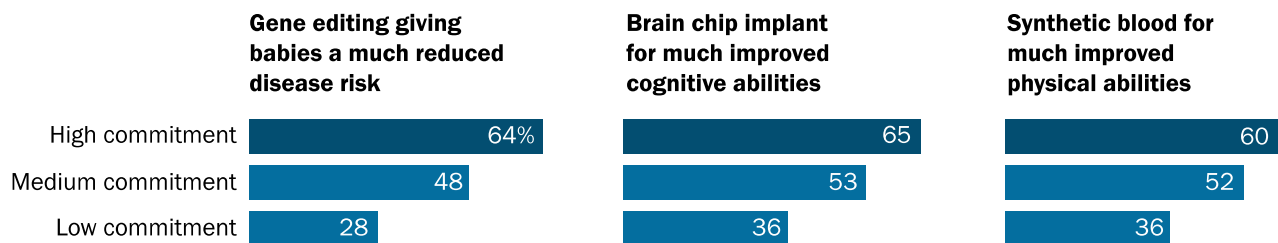
When Americans are questioned about the prospect of these specific kinds of enhancements for healthy people, their views are cautious and often resistant:

- Majorities of U.S. adults say they would be “very” or “somewhat” worried about gene editing (68%), brain chips (69%) and synthetic blood (63%), while no more than half say they would be enthusiastic about each of these developments. Some people say they would be both enthusiastic and worried, but, overall, concern outpaces excitement.
- More say they would *not* want enhancements of their brains and their blood (66% and 63%, respectively) than say they would want them (32% and 35%). U.S. adults are closely split on the question of whether they would want gene editing to help prevent diseases for their babies ([48% would, 50% would not](#)).
- At least seven-in-ten adults predict each of these new technologies will become available before they have been fully tested or understood. Some 73% say this about gene editing, while an identical share says the same about synthetic blood; 74% says this about brain chip implants.
- Majorities say these enhancements could exacerbate the divide between haves and have-nots. For instance, 73% believe inequality will increase if brain chips become available because initially they will be obtainable only by the wealthy.
- In addition, many Americans think recipients of enhancements will feel superior to those who have not received them; 63% say this about synthetic blood transfusions in particular. By the same token, but more optimistically, half of Americans or more think [recipients of enhancements](#) will feel more confident about themselves.
- Substantial shares say they are not sure whether these interventions are morally acceptable. But among those who express an opinion, more people say brain and blood enhancements would be morally unacceptable than say they are acceptable.
- More adults say the downsides of brain and blood enhancements would outweigh the benefits for society than vice versa. Americans are a bit more positive about the possibility of gene editing to reduce disease; 36% think it will have more benefits than downsides, while 28% think it will have more downsides than benefits.
- Opinion is closely divided when it comes to [the fundamental question](#) of whether these potential developments are “meddling with nature” and cross a line that should not be crossed, or whether they are “no different” from other ways that humans have tried to better themselves over time.

The survey data show several patterns surrounding Americans' wariness about these developments. First, there are strong differences in views about using these technologies for enhancement depending on how religious people are. In general, the most religious are the most wary about potential enhancements. For example, those who score high on a three-item index of religious commitment¹ are more likely than those who are lower in religious commitment to say all three types of enhancement – gene editing to give babies a lifetime with much reduced risk of disease, brain chip implants to give people much improved cognitive abilities and transfusions with synthetic blood to give people much improved physical capacities – would be meddling with nature and crossing a line that should not be crossed. Americans who have lower levels of religious commitment are more inclined to see the potential use of these techniques as just the continuation of a centuries-old quest by humans to try to better themselves.

A majority of highly religious Americans consider these potential enhancements to be meddling with nature

% of U.S. adults in each religious commitment group who say _____ is meddling with nature and crosses a line we should not cross



Note: Respondents who say “as humans, we are always trying to better ourselves and this idea is no different” or who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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¹ On this index, those who attend worship services at least weekly, pray at least once a day and say religion is very important in their lives are classified as high in religious commitment. Those low in commitment say religion is not too or not at all important in their lives, that they seldom or never attend worship services and seldom or never pray. All others are classified as exhibiting a medium level of religious commitment.

Second, people believe that technologies that would bring more dramatic or extreme changes to human abilities are less acceptable than technologies that cause less dramatic or temporary changes. For example, 47% of Americans consider the use of synthetic blood substitutes to improve physical abilities an “appropriate use of technology” if the resulting change to people’s speed, strength and stamina would be “equal to their own peak abilities.” But if the same enhancement results in physical abilities “far above that of any human known to date,” far fewer (28%) say it would be an appropriate use of technology. The same pattern occurs as Americans consider the potential use of gene editing and devices implanted in the brain to augment human abilities.

Third, women tend to be more hesitant than men about wanting the enhancements potentially

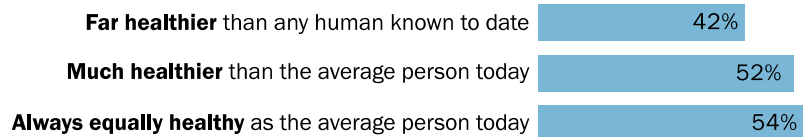
available from these cutting-edge technologies. They are also more negative than men in their judgments and expectations about what such enhancements would mean for society. Interestingly, although majorities of the public expect these enhancements would lead to increased social

Fewer Americans see enhancements that would bring extreme change as an appropriate use of technology

% of U.S. adults who say each of these enhancements would be an appropriate use of technology under each condition

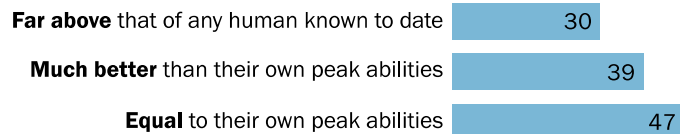
Gene editing giving babies reduced risk of serious diseases

If it resulted in people ...



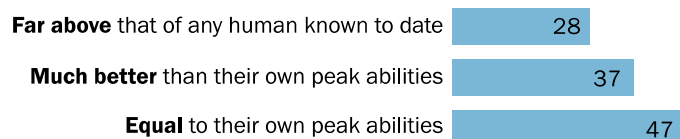
Brain chip implant improving cognitive abilities

If it resulted in cognitive abilities ...



Synthetic blood substitutes improving physical abilities

If it resulted in physical abilities ...



Note: Respondents who say each would be “taking technology too far” or who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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inequality, there are, at best, only modest differences in attitudes about these topics by race, ethnicity, educational level, income or age.

Finally, there are some similarities between what Americans think about these three potential, future enhancements and their attitudes toward the kinds of enhancements already widely available today. Many are skeptical about the need for cosmetic procedures and other *current* enhancements. For example, 61% of Americans say people are too quick to undergo cosmetic procedures to change their appearance in ways that are not really important. Roughly a third (34%) say elective cosmetic surgery is “taking technology too far.” And, overall, 54% of U.S. adults say elective cosmetic surgery leads to both benefits and downsides for society, while 26% express the belief that there are more downsides than benefits, and just 16% say society receives more benefits than downsides from cosmetic surgery.

Public assessments about cosmetic enhancements available today are mixed

% of U.S. adults who say ...

Cosmetic procedures:

People are too quick to use them in ways that are not important

It's understandable that more use them given the competitive advantage for those who look more attractive

61%

36%

Cosmetic surgery is ...

Taking technology too far

Appropriate use of technology

34%

62%

Cosmetic surgery leads to ...

More downsides than benefits

About equal benefits and downsides

More benefits than downsides

26%

54%

16%

Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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These are some of the key findings from a new nationally representative Pew Research Center survey of 4,726 U.S. adults conducted online and by mail from March 2 to 28, 2016. The margin of sampling error at the 95% confidence interval for results based on the total sample is plus or minus 2.2 percentage points.²

² Findings about enhancements available today were collected April 5 to May 2, 2016, with 4,685 U.S. adults. See the [Methodology](#) for more details.

What do we mean by human enhancement?

Human enhancement encompasses a wide range of biomedical interventions intended to increase human abilities. In simple terms, this means making biochemical, surgical or other changes designed to improve cognitive, psychological or physical capacities, and can include changes aimed at bettering physical and mental health. The modern discussion of human enhancement often is traced to an essay by Julian Huxley in 1957. The essay suggested the human species could “transcend itself” through biological intervention.³ Over the millennia, people have tried to improve their abilities by learning, as well as using tools and gadgets. Enhancement is different from those attempts at human betterment because it involves *biomedical intervention* in the body to notch up a person’s capabilities.

Many also think about human enhancement as distinct from therapeutic interventions. Thus, medical treatments aimed at *restoring* a person’s ability to see or hear – for example, to regain motor control after a stroke or spinal cord injury – would stand in contrast to *enhancing* abilities in otherwise healthy and well-functioning people beyond their current capacities (or some typical level).⁴ The line between therapy and enhancement often is blurry, but this distinction provides a framework for thinking about human enhancement in everyday terms.

Although the phrase “human enhancement” is used primarily by ethicists, there are numerous enhancements available today. Examples include: anabolic steroids used to promote muscle development; reproductive technologies, including tubal ligation and vasectomies to increase human control over the reproductive system; and an array of cosmetic interventions to change people’s physical characteristics. Two widely available cognitive enhancements include the (off-label) use of modafinil and Ritalin (methylphenidate) to stimulate a person’s focus, concentration or memory. Some also consider vaccines a form of enhancement aimed at making people healthier by reducing the probability of disease, although others consider vaccines to be firmly rooted in medical or therapeutic treatment, not enhancement.⁵

Until now, biomedical scientists have had the capacity to make only relatively modest enhancements in people. However, the convergence of innovations in biotechnology,

³ Julian Huxley, 1957. “Transhumanism.” See also Pew Research Center’s 2016 report, [“Human Enhancement: The Scientific and Ethical Dimensions of Striving for Perfection.”](#)

⁴ For more on definitions and understanding of the term see Bostrom, Nick, and Rebecca Roach. 2008. “Ethical Issues in Human Enhancement” in Jesper Ryberg, Thomas Petersen and Clark Wolf, eds., “New Waves in Applied Ethics.” Also see Savulescu, Julian, Anders Sandberg and Guy Kahane, eds., 2011. “Well-Being and Enhancement” in “Enhancing Human Capacities.” Also see Allhoff, Fritz, Patrick Lin, James Moor, and John Weckert, 2009. “Ethics in Human Enhancement: 25 Questions and Answers.” Report prepared for the National Science Foundation.

⁵ Bostrom, Nick, and Rebecca Roach. 2008. “Ethical Issues in Human Enhancement” in Jesper Ryberg, Thomas Petersen and Clark Wolf, eds., “New Waves in Applied Ethics.”

nanotechnology, information technology and other fields is raising the possibility that future enhancements could enable much more dramatic changes to human abilities. The pace of innovation is difficult to predict and sometimes takes much of the scientific community, let alone the broader public, by surprise. The development of CRISPR, a gene-editing technique, is one example in which potentially far-reaching techniques evolved very rapidly, within the space of just a few years.

Pew Research Center rooted much of this study in exploring public attitudes about breakthroughs that could expand the boundaries of human limits, potentially creating even healthier, stronger and smarter humans. In particular, the study focuses on U.S. public reactions to three potential kinds of enhancement: gene editing to give a healthy baby a much reduced risk of serious diseases and conditions over their lifetime, implanting a computer chip in the brain to give a healthy person a much improved ability to concentrate and process information, and using synthetic blood substitutes to give a healthy person much greater speed, strength and stamina. (For comparison, survey respondents also were asked about a number of procedures, such as elective cosmetic surgery, that are widely available today.)

The three future-oriented scenarios are meant to reflect the range of enhancements being discussed by scientists and others as potentially on the horizon, but it is by no means an exhaustive list.⁶ None of the techniques behind these ideas is being used for “enhancing purposes” today, although all exist in some form of development for therapeutic or medical applications. They were chosen in part because they each raise potentially enticing prospects. What if we, as a society, could virtually do away with illness? What if humans could all raise their thinking capacity manyfold? And what if synthetic “super blood” could boost physical prowess to “superman” and “superwoman” levels?

Whatever appeal these ideas may have, they also raise fundamental questions about what it means to be human. From the earliest days of civilization, people have sought to better their condition through the use of tools, medications, surgeries and other therapies. But as new scientific and technological breakthroughs arise, so do questions about whether such developments move beyond limits set by God, nature or reason. Thus, this research is aimed in part at understanding where, if at all, the public might “draw the line” on human enhancements and the possibilities they could bring to society.

⁶ A 2013 [Pew Research Center report](#) focused on Americans’ and experts’ views about a related idea: the possibility that medical advances coming in the future could slow the aging process and allow people to live, on average, decades longer. Both that report and this one are part of the Center’s ongoing work in emerging biotechnological developments that could raise broad social, ethical and religious challenges for society.

Talking through the potential benefits and costs of human enhancement: A report from six focus groups

To enrich the survey findings, Pew Research Center conducted six focus group discussions around the country. “[American Voices on Ways Human Enhancement Could Shape Our Future](#)” examines the themes that arose in these discussions, many of which focused on where to draw the moral and ethical boundaries when considering scientific breakthroughs that could enhance human capabilities.

- Many felt that while no effort should be spared to help the sick, society should proceed with caution before allowing biomedical advancements to boost the capacities of healthy people, fearing a slippery slope toward the creation of “superhumans” or human “robots.”
- While each of these enhancements could be seen as humans “playing God,” some participants argued that these biomedical advances can be morally justified because God intended for humans to make the most of their abilities and to better humankind.
- Potential risks and abuses of these enhancements highlight the need for oversight; many thought the guideposts for regulations should be “do no harm” and “be fair.”
- There was broad consensus that no enhancement should ever be imposed on anyone against his or her will.
- The calculations and guideposts people use have a distinctive character depending on type of enhancement.

For more detailed results and quotes from these in-depth discussions, see the accompanying [report](#).

1. Understanding patterns in Americans' reactions to gene editing, brain chip implants and synthetic blood transfusions that push boundaries of the human condition

Americans are of two minds when they consider scientific advancement. In broad terms, they think scientific and technological innovations are of benefit to society. But when it comes to using particular cutting-edge technologies to potentially augment human abilities – such as allowing parents to edit their baby's genes for a lifetime of much reduced disease, or offering brain chip implants or synthetic blood substitutes to healthy people who want to perform at higher levels – a new Pew Research Center survey suggests people's concern rises.

This chapter explores Americans' familiarity with, and thoughts about, several techniques on the vanguard of science that could be used to expand the limits of people's bodies and brains. It examines the patterns that run across public opinion on the three case studies, including the large differences in acceptance between highly religious and less religious Americans; the tendency of people to be more open to these technologies if their effects would be controllable and less dramatic in magnitude; the gender gap in opinions on this topic, with women more wary than men about these developments; and the links between views toward enhancements widely available today, such as cosmetic surgery or laser eye surgery; and views toward potential future enhancements.

Experts' take on humanity's quest to better itself

Pew Research Center conducted interviews with scientists, ethicists and religious leaders about the scientific and ethical dimensions of human enhancement. "[Human Enhancement: The Scientific and Ethical Dimensions of Striving For Perfection](#)" summarizes the proponents' chief arguments, many of whom call themselves transhumanists, and reviews the chief cautions raised by bioethicists and the still-nascent views of major religious traditions as they grapple with the potential of cutting-edge technologies that would change human capabilities.

Most Americans not interested in improving their cognitive or physical abilities with brain chips or synthetic blood

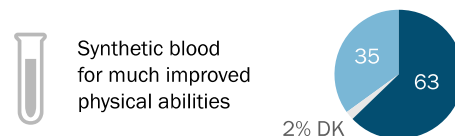
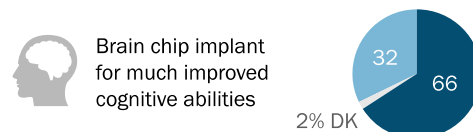
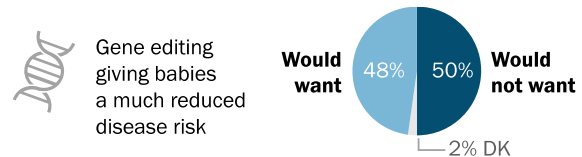
Converging technologies in biomedical, nanotechnology, information technology and other fields could lead to any number of ways humanity might be able to “upgrade” itself. The Pew Research Center study focuses on the U.S. public’s reactions to three particular kinds of technologies that could be used in the relatively near-term for human enhancement: gene editing to give a healthy baby a much reduced risk of serious diseases and conditions over their lifetime; implanting a computer chip in the brain to give a healthy person a much improved ability to concentrate and process information; and a transfusion with synthetic blood to give healthy people much improved speed, strength and stamina.

Overall, none of the three enhancements are particularly appealing to the general public. Altogether, 50% of Americans say they would *not* want gene editing to significantly reduce their own baby’s risk of serious diseases and conditions. A roughly equal share of adults (48%) say they would probably or definitely want this for their baby.

U.S. adults are even less eager to get a brain chip implant or synthetic blood. Roughly two-thirds of Americans (66%) say they would *not* be interested in an implanted device designed to give them a much improved ability to concentrate and process information; a third (32%) say they would definitely or probably want such a device. The same pattern occurs when it comes to a synthetic blood substitute for much greater speed, strength and stamina. Most Americans (63%) say they would not want this, while 35% say they would definitely or probably want it.

Half or more of public says they would not want these enhancements

% of U.S. adults who say they would want or would not want these enhancements for their baby/for themselves



Note: “Definitely” would/would not want and “probably” would/would not want responses combined. Respondents who did not give an answer are shown as DK.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Gene editing to improve a baby’s health appears more appealing to the public as a whole than the other two scenarios. This difference could stem from the fact that the gene-editing scenario is focused on disease-prevention, while the other two scenarios are more about augmenting abilities.

Another possibility is that public thinking about genetic interventions that would enhance their children's characteristics involves different calculations than changes to better themselves. Still, there are striking similarities detailed below in how Americans evaluate the likely outcomes and moral acceptability of all three of these potential enhancements.

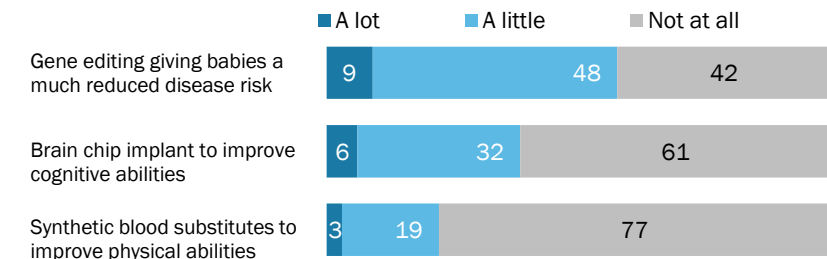
Some have heard about these ideas, especially gene editing, but few have heard a lot

As might be expected when it comes to future possibilities, few Americans report deep familiarity with gene editing, chip implants or synthetic blood substitutes. But 48% of adults say they have heard a little about the idea of gene editing for babies and another 9% say they have heard a lot. Nearly four-in-ten adults have heard either a lot (6%) or a little (32%) about brain chip implants. The idea of synthetic blood substitutes to boost physical speed, strength and stamina is less familiar, by comparison; 77% of Americans have heard nothing at all about this possibility.

Those who have heard at least a little about these ideas are more inclined to want these enhancements for themselves (or, in the case of gene editing, for their baby). While greater familiarity with these ideas could be driving more desire for these enhancements, at this early stage, it could be simply that people who are predisposed to favor new technologies seek out information about new technological developments and also tend to favor these possibilities.

Limited awareness of human enhancements as of now

% of U.S. adults who have heard or read about each topic before today



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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A similar pattern was found in a 2013 [Pew Research Center study on radical life extension](#). Those who had heard more about this idea were more likely to say they would want medical treatments to slow the aging process and extend average lifespans by decades.

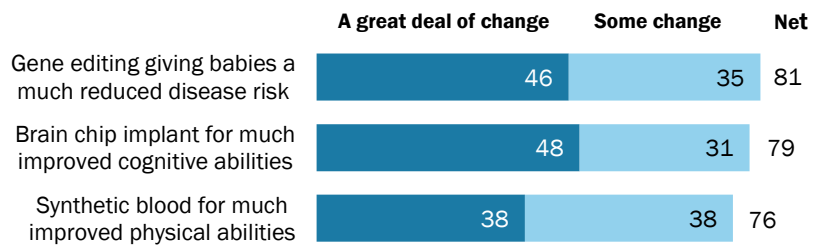
Most Americans see human enhancements causing major changes ahead, but more expect negative rather than positive effects

There is widespread agreement among the public that if the enhancements considered in the survey become widely available for healthy people, change will follow. But significantly more Americans expect negative outcomes, including premature adoption of techniques that are not well tested and increased social inequality.

Some 81% of adults say gene editing that would give babies a much reduced risk of serious diseases over their lifetime would cause either a great deal of change for society (46%) or some change (35%). A similar share – 79% – say an implanted brain chip giving healthy people a much improved ability to concentrate and process information would lead to at least some change. And 76% of adults say transfusions of synthetic blood to give healthy people much improved physical abilities would cause a great deal of change (38%) or some change (38%) for society.

Majorities say these enhancements will bring at least some change to society

% of U.S. adults who say each of these enhancements will cause _____ to society



Note: Respondents who said “not too much” or “not at all” and those who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Focus groups raise the potential for unexpected consequences

Focus group participants mentioned a number of ideas about how these kinds of enhancements could affect people’s personalities, family relationships, health and performance on the job, as well as intergroup relations in society as a whole.

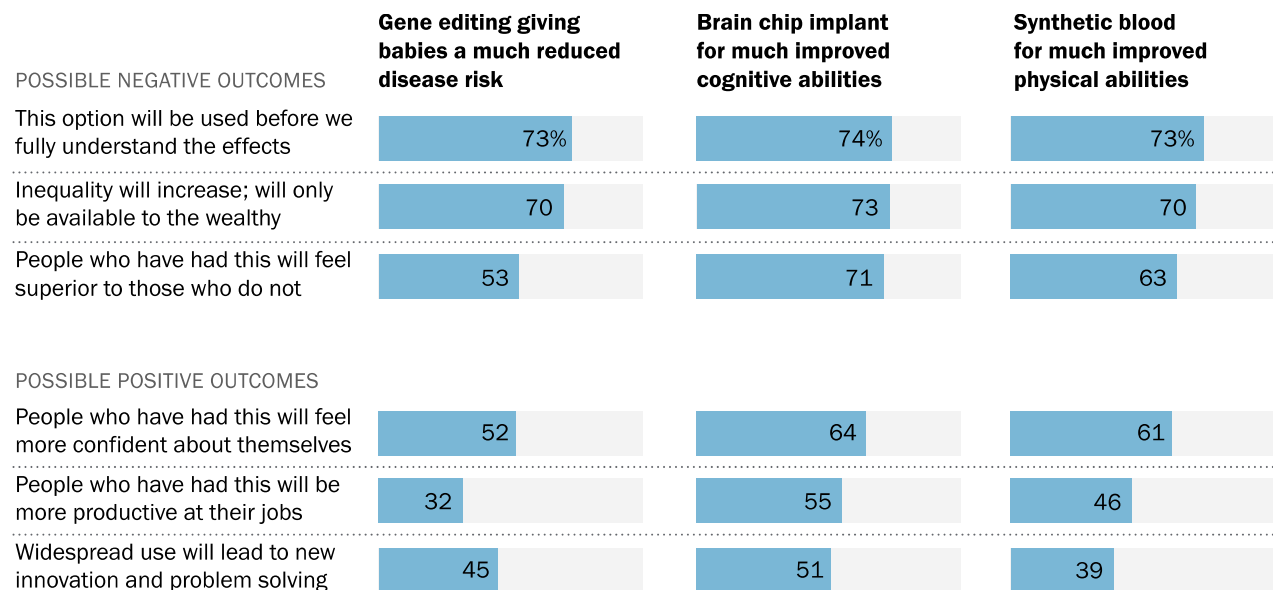
Among the points raised were concerns about potential misuse of enhancements, especially by people with criminal intent. Others mentioned a general concern that implanted devices could become obsolete without an “upgrade.” Similar concerns were raised about using synthetic blood substitutes and gene-editing techniques. See [“American Voices on Ways Human Enhancement Could Shape Our Future.”](#)

In terms of the potential outcomes of adopting these techniques, more Americans anticipate negative rather than positive consequences. At the top, at least seven-in-ten adults are concerned that these new technologies will become available before they have been fully tested or understood. This concern was echoed in the focus group discussions, particularly in connection with brain chip implants.

Another mark on the minus side of the chart: Many Americans think these developments could exacerbate the divide between the haves and have-nots in society. Some seven-in-ten survey respondents say inequality would increase because only the wealthy could afford these enhancements.

Most Americans expect more negative than positive outcomes from each of these enhancements

% of U.S. adults who say _____ is likely to happen if each of these enhancements becomes available



Note: Respondents who said “not likely” or did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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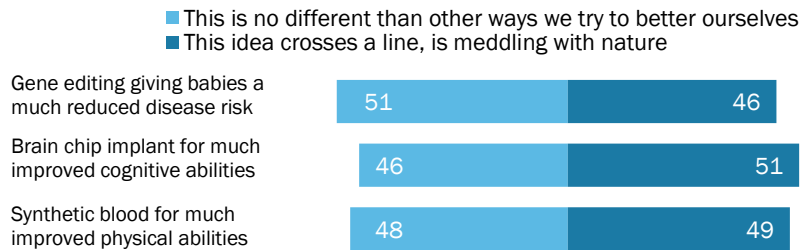
Jury is still out on moral acceptability: Are humans bettering themselves or meddling with nature?

Americans are closely divided on the key ethical question of whether gene editing, brain chip implants, or synthetic blood substitutes are just another step in a long line of efforts humans have made over time to better themselves, or if, instead, these ideas are “meddling with nature” and, as such, cross the bounds of what humans should do. In each case, the public is nearly evenly divided between the two perspectives.

When it comes to moral evaluations of these potential human enhancements, there also are wide differences among the public as a whole. A sizeable portion of the public says they are “not sure” whether these three possible enhancements are morally acceptable. Among the remainder, the balance of opinion is closely divided over whether gene editing that would give babies a much reduced risk of disease is morally acceptable (28%) or unacceptable (30%). The balance of opinion leans negative for brain chip implants (23% say this is morally acceptable and 37% say it is unacceptable) and synthetic blood (22% vs. 35%).

Public closely divided over whether human enhancements are ‘meddling with nature’

% of U.S. adults who say _____ about each type of enhancement



Note: Respondents who did not give an answer are not shown.

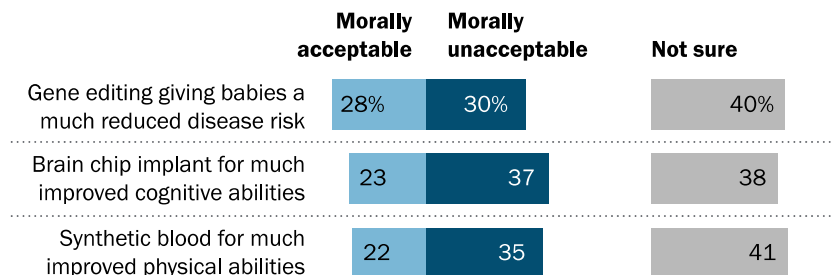
Source: Survey of U.S. adults conducted March 2-28, 2016.

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Balance of opinion is negative or equally divided over moral acceptability of these enhancements

% of U.S. adults who say each of these enhancements would be ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Asked to explain their reasons, many of those who said gene editing to give babies reduced risk of disease is morally unacceptable raised concerns that this “interferes with God’s plan” or is “messing with nature.”

On the other hand, some of those who say gene editing is morally acceptable reasoned that gene editing was similar to other kinds of medical advances and improvements society has made over time or that these emerging technologies will have positive effects for society.

Similar themes emerge when it comes to the moral acceptability of brain chip implants or synthetic blood substitutes. In thinking about moral objections to the possibility of brain chip implants, some respondents made explicit mentions of religion, especially concerning the similarity of this idea to the “mark of the beast” as foretold in the Bible’s book of Revelation.

Religious beliefs are prominent reasons why 30% of adults say gene editing is morally unacceptable

Respondents who said gene editing giving healthy babies a much reduced risk of serious diseases and conditions would be morally unacceptable were asked to explain, in their own words, why.

MOST COMMON RESPONSES BY CATEGORY		SAMPLE RESPONSES
References to changing God’s plan	34%	“God is the Creator. Messing with the DNA is crossing the line.” “We shouldn’t be ‘editing’ what God has created to be perfect in its own way.”
Disrupting nature, crossing a line we should not cross	26%	“It’s messing with nature. Nothing good can come from that.” “Once we begin gene editing babies, where does it end?”
Could be controlled or used for bad motives	9%	“Far too much room for misuse.” “I feel this would open the door to more manipulation of humans in an attempt to create a superior race.”
Could have unintended consequences	8%	“Not enough is known about manipulation of genes which could lead to outcomes we would not be aware of or want.” “Adjusting the balance in our genes could have profound and unpredictable outcomes in the way our personalities and talents develop.”
Unnecessary, especially for healthy people	5%	“It is not natural.” “Nobody is perfect; we all have to accept how we are born.”
All other responses	28%	
Don’t know/not sure	27%	

Note: Based on those who said gene editing would be morally unacceptable. Verbatim responses are coded into categories; figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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Key patterns in Americans' attitudes about human enhancements

Beyond these readings of overall opinion, several consistent patterns in people's views about these human enhancements stand out. First, people's opinions across all three scenarios are strongly connected with their religiosity. More religious Americans are, on average, less likely to embrace these potential types of human enhancement. This stands in contrast to more modest differences by religious affiliation and frequency of religious service attendance in the [2013 Pew Research Center report](#) which explored public views about another form of human enhancement: radical life extension. And, a [2014 Pew Research Center survey](#) found only a handful of issues where people's religious beliefs and practices have a strong connection to their views about a range of science-related issues.

A second consistent pattern is that people are less accepting of enhancements that produce extreme changes in human abilities. And, if an enhancement is permanent and cannot be undone, people are less inclined to support it.

And, third, one demographic pattern stands out: Women are consistently more wary than men about these potential enhancements. At the same time, there are few differences in opinion across racial and ethnic groups, education and income levels, or age groups.

As a point of comparison, this study also examined public thinking about a handful of enhancements widely available today, including elective cosmetic surgery, laser eye surgery, skin or lip injections, cosmetic dental procedures to improve one's smile, hair replacement surgery and vasectomy or tubal ligation procedures to prevent pregnancy. There is a similar strain to public views about *current* enhancement practices in that most Americans say "people are too quick to undergo cosmetic procedures in order to change their appearance in ways that are not really important." And, when it comes to evaluations of elective cosmetic surgery, in particular, more say the downsides outnumber benefits for society than vice versa; about half of Americans say the benefits and downsides equal out.

The next part of this report goes through those patterns in more detail.

Pattern 1: Public views are strongly connected with religious differences; the more religious are most negative while the least religious are most positive

People's views about human enhancements are strongly linked with their religiosity. The Center created an index of three common measures of religious commitment – how people describe the importance of religion in their lives, how often they attend worship services and how often they pray.⁷ Across all three human enhancement scenarios, the highly religious are much less positive about these human enhancements. Those who are less religious, by comparison, are much more likely to want each of these enhancements, to see them as akin to other ways humans have tried to better themselves and, on balance, to see them as morally acceptable and likely to bring more positives than negatives to society if implemented.

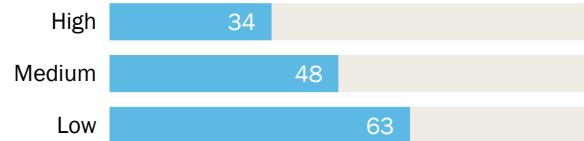
Some 63% of those with low religious commitment say they would want gene editing for their baby to reduce the risk of serious diseases and conditions. Just 34% of the most religious say the same, a difference of 29 percentage points. A similar pattern occurs when it comes to desire for an implanted device to dramatically improve one's concentration and ability to process information; 44% of those low in religious commitment would want this, compared with 24% of those high in religious commitment. The figures are roughly the same in reaction to getting a transfusion with synthetic blood substitutes to dramatically improve one's speed, strength and stamina.

Highly religious Americans less likely to want each of these enhancements

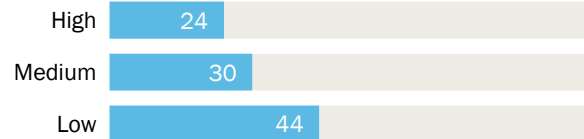
% of U.S. adults in each religious commitment group who say they would want ...

Gene editing giving their baby a much reduced disease risk

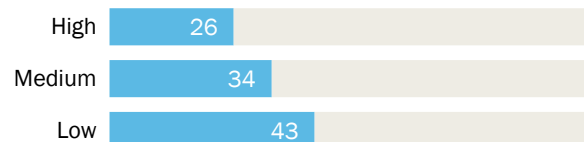
Among those ... on the religious commitment index



Brain chip implant for much improved cognitive abilities



Synthetic blood for much improved physical abilities



Note: "Definitely" would and "probably" would responses combined. Respondents who would "definitely" or "probably" not want this or who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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⁷ See [Methodology](#) for details on the index of religious commitment.

More religious adults are more likely to assess each of these human enhancements as “meddling with nature,” crossing a line that should not be crossed. Six-in-ten or more of those high in religious commitment say this about gene editing to give babies a reduced risk of serious disease, brain chip implants to improve cognitive function and synthetic blood substitutes to improve physical abilities. By contrast, majorities of those low in religious commitment say each of these enhancements would be no different from other ways humans try to better themselves.

Differences by religiosity remain strong and significant even when taking into account other factors that tend to be related to religious commitment in modern America, such as gender, race and ethnicity, age and education. To give one example, when statistically controlling for other factors, those high in religious commitment are, on average, 32% more likely than those low in religious commitment to say gene editing that would give babies a much reduced risk of serious diseases is meddling with nature.⁸

There are similarly strong differences by religious commitment levels in moral judgments about these enhancements. While a sizable minority says they are not sure about the moral

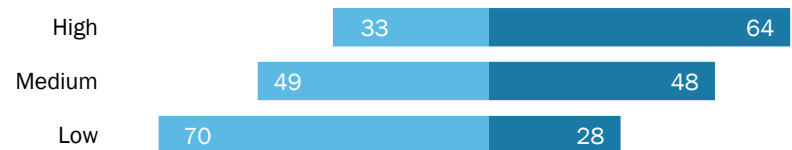
Highly religious Americans tend to say these enhancements are meddling with nature

% of U.S. adults in each group who say ...

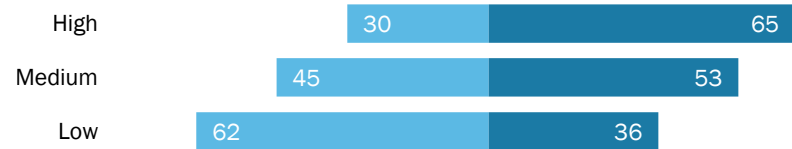
- This is no different than other ways we try to better ourselves
- This idea crosses a line, is meddling with nature

Gene editing giving babies a much reduced disease risk

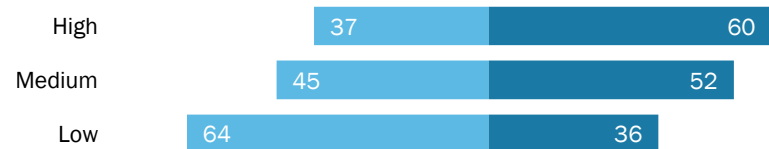
Among those ... on the religious commitment index



Brain chip implant for much improved cognitive abilities



Synthetic blood substitutes for much improved physical abilities



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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⁸ These figures are based on statistical modeling using logistic regression to predict whether an individual says gene editing is “meddling with nature.” The model includes gender, race/ethnicity, age, education, religious affiliation and religious commitment as predictor variables. The average difference is calculated by taking the difference between the predicted probability for an individual with a high religious commitment and an individual with low religious commitment, holding medium religious commitment at zero and all other variables at their means.

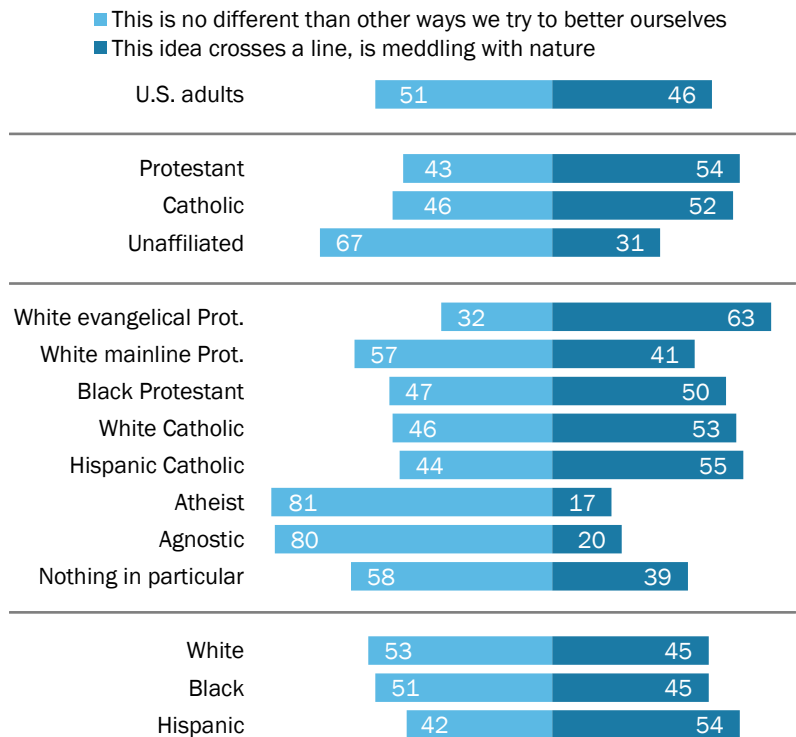
acceptability of these enhancements, those high in religious commitment are more likely to say each of these ideas is morally unacceptable rather than acceptable by a ratio of about 2.5-to-1. But, the balance of opinion goes in the opposite direction among those low on the religious commitment index.

There also are substantial differences by religious affiliation in views about human enhancements. For example, 63% of white evangelical Protestants say gene editing that would give babies a much reduced risk of serious diseases would be meddling with nature, compared with half as many people with no religious affiliation who say this (31%).

Self-described atheists and agnostics, in particular, stand out from other religious groups on this question. Strong majorities of atheists (81%) and agnostics (80%) say gene editing to give healthy babies a much reduced chance of disease is similar to other ways humans have tried to better themselves over the years.

White evangelicals especially likely to say gene editing for babies crosses a line; most atheists and agnostics say it is just another avenue to betterment

% of U.S. adults who say gene editing giving healthy babies a much reduced risk of serious diseases and conditions ...



Note: Respondents who did not give an answer are not shown. Whites and blacks are non-Hispanics only. Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Negative reactions to human enhancement are particularly strong among the most committed white evangelical Protestants

In comparison with most other religious groups, white evangelical Protestants are less likely to want these enhancements and more likely to express reservations about these possible developments.

Reservations are particularly common among white evangelicals who are higher in religious commitment – that is, those who say religion is very important in their life, attend religious services at least weekly and engage in prayer every day.

For example, 27% of highly religious white evangelical Protestants say they would want gene editing for their baby, compared with 41% of white evangelicals with medium levels of commitment and 48% of the general public.

And, white evangelical Protestants who are highly religious are more inclined than those with a medium level of commitment to consider each of these enhancements as “meddling with nature” and crossing a line that should not be crossed. Some 71% of highly committed white evangelicals say this about gene editing, compared with 56% among those with a medium level of commitment.

White evangelical Protestants with higher religious commitment are especially wary of these enhancements

% of white evangelical Protestants who are high or medium in religious commitment who say ...

	White evangelical Protestants	
	High	Medium
Would definitely/probably want		
Gene editing for their baby	27%	41%
Brain chip implant	14	22
Synthetic blood substitute	19	32
This is meddling with nature, crosses a line we should not cross		
Gene editing giving babies a much reduced disease risk	71	56
Brain chip implant for much improved cognitive abilities	76	62
Synthetic blood substitute for much improved physical abilities	71	58

Note: Based on white evangelical Protestants. Respondents who gave other responses or who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Pattern 2: Enhancements that produce more extreme or permanent effects are seen as less acceptable

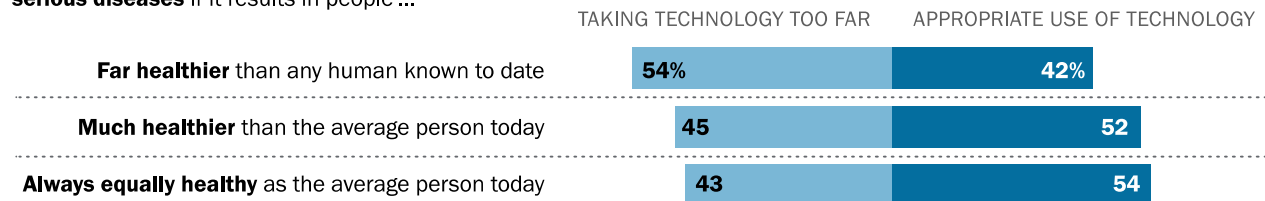
Public views about human enhancements are linked with the magnitude of change such enhancements are expected to bring as well as with their permanence. When considering an enhancement with more extreme effects – a change that would help a person operate “far above” their current abilities – fewer people say the enhancement would be an appropriate use of technology.

For example, only 28% of adults say a synthetic blood substitute would be an appropriate use of technology if it produced improvements to speed, strength and stamina that were “far above that of any human known to date.” By contrast, some 47% of adults say synthetic blood products would be appropriate if the magnitude of change was much smaller. In this case, that might mean a synthetic blood transfusion that helped a person reach their own peak abilities for speed, strength and stamina, rather than helping a person surpass their best efforts in the past.

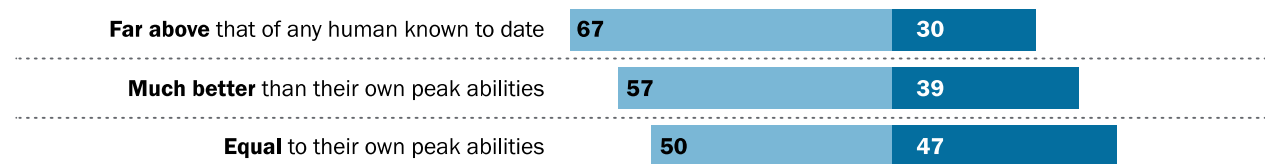
Fewer adults say these enhancements would be appropriate if the change they produced in humans is 'far above' that known today

% of U.S. adults who say each of these enhancements would be _____ under each condition

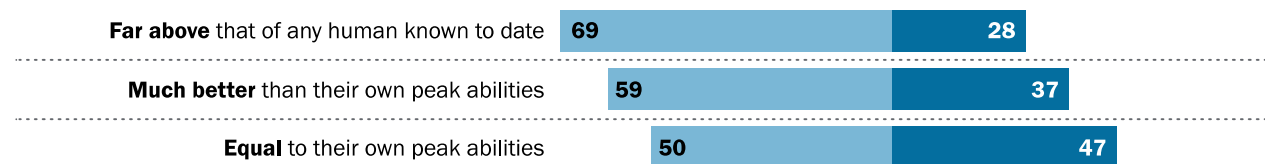
Gene editing giving babies reduced risk of serious diseases if it results in people ...



Brain chip implant improving cognitive abilities if it results in abilities ...



Synthetic blood substitutes improving physical abilities if it results in abilities ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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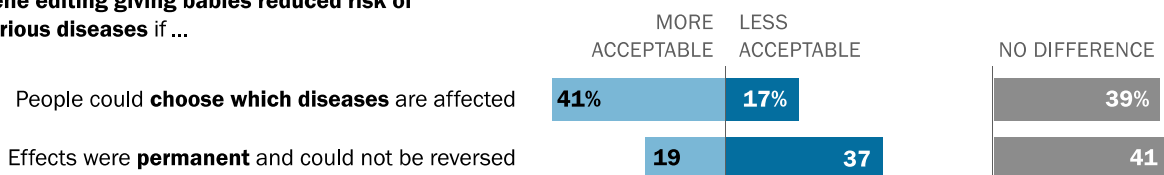
In addition, people's reactions to human enhancements are more positive if the effects are controllable or temporary. For example, 32% of adults say if the implanted devices giving people better concentration and cognitive processing abilities could be "turned on and off" they would be more acceptable. Far fewer adults (16%) say the ability to control the effects of an implanted device would make this idea less acceptable.

In thinking about a scenario in which the effects of a brain chip would be permanent and irreversible, about half of Americans (51%) say this would make the technology less acceptable to them. Only 8% say this would make it more acceptable.

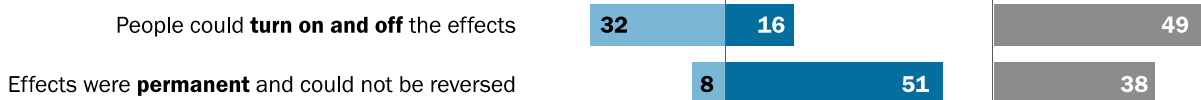
Enhancements that allow control over effects seen as more acceptable; permanent effects less acceptable

% of U.S. adults who say each of these enhancements would be _____ under each condition

Gene editing giving babies reduced risk of serious diseases if ...



Brain chip implant improving cognitive abilities if ...



Synthetic blood substitutes improving physical abilities if ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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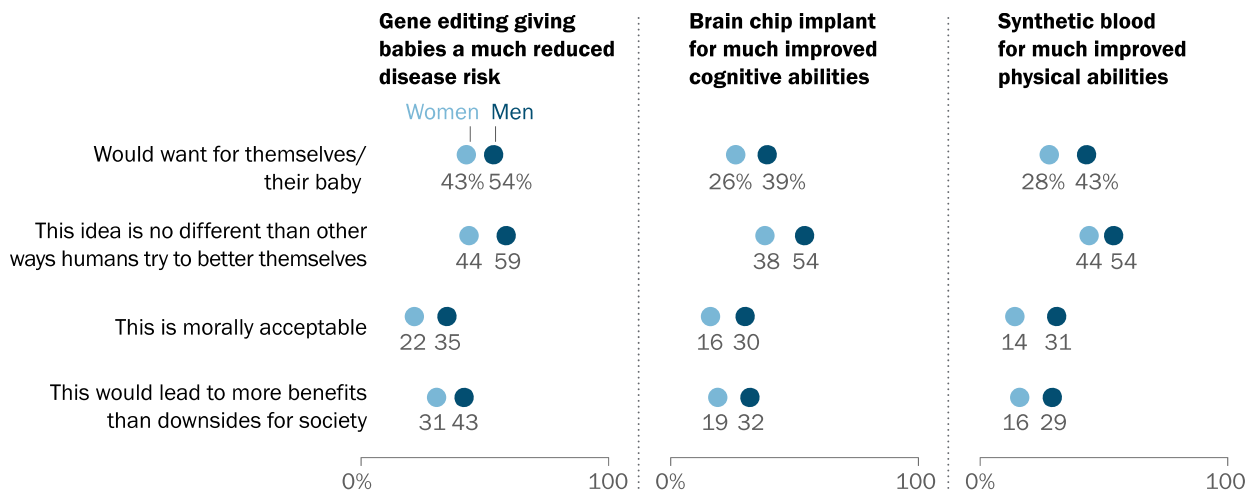
Pattern 3: Women are consistently more wary than men about these potential enhancements

Men are more inclined than women to respond positively to each of the three kinds of human enhancement considered in the survey. Specifically, men are more likely than women to say they would probably or definitely want gene editing to give their baby a much reduced risk of serious disease, an implanted device to improve their concentration and information processing abilities or synthetic blood substitutes to improve their speed, strength and stamina.

Women are less inclined than men to consider each of these enhancements similar to other ways humans try to improve themselves. To give one example, some 54% of men (compared with 38% of women) say implanting devices in the brain to give healthy people a much improved ability to concentrate and process information is akin to other ways humans try to better themselves. Additionally, more women than men say such devices would be meddling with nature and crossing a line that should not be crossed.

Men are more inclined than women to want these enhancements

% of U.S. adults who say ...



Note: "Definitely" would and "probably" would responses combined. Other responses and those who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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While men and women are about equally likely to expect at least some change for society from each of these enhancements, men, more than women, say each of these enhancements would bring net benefits for society.⁹

The way people think about today's enhancements, for example cosmetic surgery, has some similarity to the way they think about tomorrow's potential enhancements

One factor in public reactions to these kinds of human enhancements could well stem from the fact that each is, as yet, only available in very limited circumstances and each is largely unfamiliar to the general public.

For comparison, the survey included a series of questions about “enhancing” procedures widely available today.¹⁰ The results suggest that most people accept modern cosmetic enhancements, even as they believe Americans are too quick to adopt these changes.

Overall, a majority of Americans (61%) say “people are too quick to undergo cosmetic procedures in order to change their appearance in ways that are not really important,” while 36% said “it’s understandable that more people undergo cosmetic procedures these days because it’s a competitive world and people who look more attractive tend to have an advantage.”

As is the case in views about the three more cutting-edge enhancements considered in this project, public views about cosmetic procedures generally tend to differ by religious commitment, although these differences are not as stark.

Most Americans say people are too quick to undergo cosmetic procedures

% of U.S. adults who say ____ about cosmetic procedures



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

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The survey asked for judgments about six specific kinds of procedures widely available today including elective cosmetic

⁹ The patterns between men and women are statistically significant in multivariate statistical models that control for religious commitment, religious affiliation and other background factors. Thus, the tendency among women in the U.S. to exhibit [higher levels of religious commitment](#), on average, does not fully explain the gender patterns here. A [2014 Pew Research Center survey](#) also found men more likely than women to expect future technological changes, in general, to make people’s lives better. Though men and women held similar views on three of four assessments about whether specific innovations would bring more positive or negative change for society.

¹⁰ These questions were asked on a separate survey conducted about one month later.

surgery, laser eye surgery, skin or lip injections, cosmetic dental procedures to improve one's smile, hair replacement surgery and vasectomy or tubal ligation procedures to prevent pregnancy. Each of the six was judged to be an "appropriate use of technology" among half or more of the general population. Overwhelming majorities say laser eye surgery (89%) and cosmetic dental procedures to improve one's smile (86%) are appropriate uses of technology. Smaller majorities say this about elective cosmetic surgery (62%) and skin or lip fillers (53%).

Public opinion about elective cosmetic surgery has a negative tinge: More judge the overall benefits of such surgery for society to be negative than positive (26% compared with 16%), even as a 54% majority says the net effects of cosmetic surgery on society are a wash.

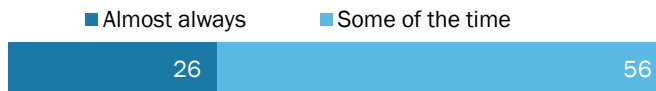
Public judgments about potential effects for those who undergo cosmetic surgery are mixed. Some 26% of adults say those who have elective cosmetic surgery almost always "feel more confident and better about themselves." While several focus group participants worried that future enhancements would result in unexpected side effects, just 8% of the general public says cosmetic surgery "almost always" leads to unexpected health problems; 63% say it sometimes does.

Understandably, the 4% of U.S. adults who say they themselves have had some kind of elective cosmetic surgery hold more positive views about it. And, people who tend to see the kinds of procedures widely available today in a negative light, saying, for example, that people are too quick to undergo cosmetic procedures that are not really important, are more wary about human enhancement from gene editing, brain chip implants or synthetic blood substitute.

Most Americans say cosmetic surgery leads to both benefits and downsides for society

% of U.S. adults who say elective cosmetic surgery leads to...

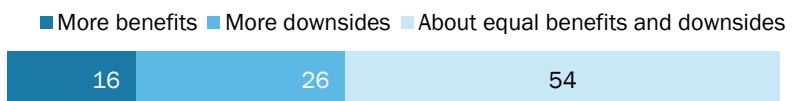
People feeling more confident and better about themselves



Unexpected health problems



Overall effect on society



Note: Respondents who gave other responses and those who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

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Minimal differences by income, education on future enhancements, but there are more divides when it comes to enhancements widely available today

When it comes to the cutting-edge human enhancements considered in this report, there are surprisingly few differences in assessments across class lines: Neither education nor family income is a strong predictor of views. This is despite the fact that the most adults see future social inequality tied to unequal access to these human enhancements.

Those with higher family incomes are, however, more likely to have had one of six kinds of enhancements widely available today (e.g., laser eye surgery to enhance one's vision or elective cosmetic surgery). And adults with middle- and higher-family incomes are more likely than those with lower incomes to say each of these six kinds of procedures available today is an appropriate use of technology. The same pattern occurs by education level, with college graduates more likely than those with a high school diploma or less schooling to say each of these procedures is an appropriate use of technology.

Similar reactions to future human enhancements among white, blacks and Hispanics

There are few differences in views about these cutting-edge human enhancements among whites, blacks and Hispanics. People in these three groups are about equally likely to say they would definitely or probably want gene editing for their baby, an implanted device for themselves or synthetic blood substitutes for themselves. And whites, blacks and Hispanics assess the potential benefits and downsides for society in similar ways.

Hispanics are a bit more likely than whites to consider gene editing for babies to be meddling with nature (54% of Hispanics say this, compared with 45% of whites). The share of blacks who say this (45%) is not statistically different than the shares of whites or Hispanics.

The similarity in views across racial and ethnic groups stands in contrast to views about a different kind of enhancement: radical life extension. A 2013 Pew Research Center survey on the idea of medical treatments that could potentially slow the aging process and extend the average person's life expectancy by decades found [blacks and Hispanics more likely than](#)

[whites](#) to say radical life extension would be a good thing for society. Blacks and Hispanics were also somewhat more likely than whites to say they would want life-extending treatments.

While this new study finds a number of similarities in judgments about these three types of enhancement, it is useful to remember that different patterns may emerge about other kinds of human enhancement.

Few differences by race or ethnicity in views about these enhancements

% of U.S. adults in each racial/ethnic group who say ...

	White	Black	Hispanic
Would definitely/probably want			
Gene editing for their baby	50%	47%	42%
Brain chip implant	33	32	30
Synthetic blood substitute	34	35	38

This is meddling with nature, crosses a line we should not cross

Gene editing giving babies much reduced risk of disease	45	45	54
Brain chip implant for much improved cognitive abilities	53	49	50
Synthetic blood substitute for much improved physical abilities	50	46	47

Note: Respondents who gave other responses and those who did not give an answer are not shown. Whites and blacks are non-Hispanic only. Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Parents of minor children are more reluctant about gene editing for babies

Parents of minor-aged children are more hesitant than others about gene editing for babies. Parents are less inclined than others to say they would want gene editing for their babies to reduce the risk of serious diseases; they are more likely to consider this idea meddling with nature, to see it as morally unacceptable and to judge that it would bring more downsides than benefits for society as a whole.

While most parents fall within the middle age groups (ages 30 to 64), there are no more than modest generational divides over gene editing. And, views among adults by age differ only modestly, if at all, about using gene editing to improve the health and abilities of the healthy, when controlling for those who have minor age children.

Parents are less inclined to want gene editing for their baby

% of U.S. adults in each group who say ...

	Parent of child under 18	No child under 18
Gene editing giving babies a much reduced risk of serious disease		
Yes, would want for their baby	39%	53%
No, would not want for their baby	59	45
As humans, we are always trying to better ourselves and this idea is no different	41	56
This idea is meddling with nature and crosses a line we should not cross	56	42
Morally acceptable	20	31
Morally unacceptable	38	26
Not sure	39	41
More benefits than downsides	29	39
More downsides than benefits	33	26
About equal downsides and benefits	34	33

Note: "Definitely" would/would not want and "probably" would/would not want responses combined. Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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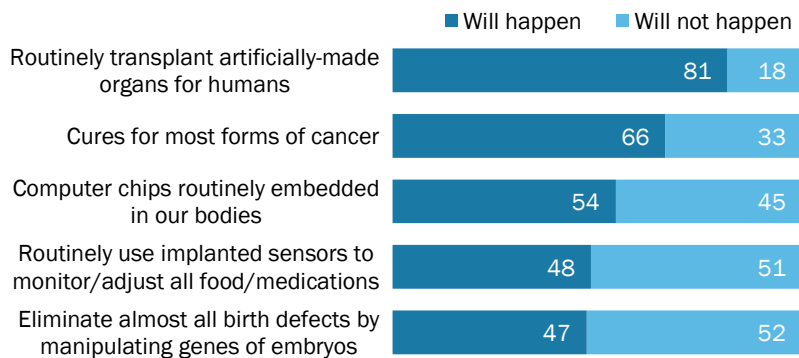
Is change inevitable?

Whether or not the public generally wants human enhancements, most expect changes along these lines to occur within the next 50 years. Medical science is now only occasionally using artificially made human organs for transplants. As Americans consider the future, fully 81% expect such organs to be routinely available for transplant by the year 2066. Roughly two-thirds (66%) of Americans say scientists will probably or definitely cure most forms of cancer by the year 2066.

When it comes to ideas closely linked with the three enhancements that anchor this survey, roughly half of adults (54%) think the idea of implanted computer chips is likely to be a routine occurrence in the future. Some 48% say humans will definitely or probably use implanted sensors to monitor or adjust all food and medications that enter the bloodstream by the year 2066. And a similar share of adults, 47%, foresees a future with almost no birth defects because of genetic modification of embryos prior to birth.

Nearly half or more expect these changes will come to pass within 50 years

% of U.S. adults who say each of the following will happen or will not happen in the next 50 years



Note: "Definitely" will/will not happen and "probably" will/will not happen responses combined. Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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2. U.S. public opinion on the future use of gene editing

The potential genetic modification of humans and its ramifications have long been debated, but a recent scientific breakthrough in gene editing – a technique known as CRISPR – has raised the urgency of this conversation. In March and April of 2015, two separate groups of scientists published essays urging the scientific community to impose limits on genomic engineering, and the [National Academies of Sciences](#), working in cooperation with the United Kingdom’s Royal Society and the Chinese Academy of Sciences, convened an international summit to discuss the science and policy of human gene editing. (For more details on these developments, see “[Human Enhancement: The Scientific and Ethical Dimensions of Striving for Perfection](#).”)

The Pew Research Center survey gauged, in broad terms, what the public thinks about the potential use of gene editing to enhance people’s health, in this case by reducing the probability of disease over a person’s lifetime.¹¹ Survey respondents were asked to consider a potential future scenario, republished in the accompanying sidebar, in which gene editing would be used to give healthy babies a much reduced risk of developing serious diseases. Gene-editing techniques are not currently being used in this way.

While many Americans say they would want to use such a technology for their own children, there is also considerable wariness when it comes to gene editing, especially among parents of minor children. Highly religious Americans are much more likely than those who are less religious to say they would *not* want to use gene-editing technology in their families. And, when asked about the possibility of using human embryos in the development of gene-editing techniques, a majority of adults – and two-thirds of those with high religious commitment – say this would make gene editing less acceptable to them.

Gene editing giving babies much reduced risk of serious disease

Respondents to the Pew Research Center survey read the following statement: “New developments in genetics and gene-editing techniques are making it possible to treat some diseases and conditions by modifying a person’s genes. In the future, gene-editing techniques could be used for any newborn, by changing the DNA of the embryo before it is born, and giving that baby a much reduced risk of serious diseases and conditions over his or her lifetime. Any changes to a baby’s genetic makeup could be passed on to future generations if they later have children, and over the long term this could change the genetic characteristics of the population.”

¹¹ A [2013 Pew Research Center report](#) looked at public attitudes connected with aging and potential biomedical technologies to radically extend people’s lifespan.

This chapter focuses on these patterns and several others involving public attitudes about gene editing.

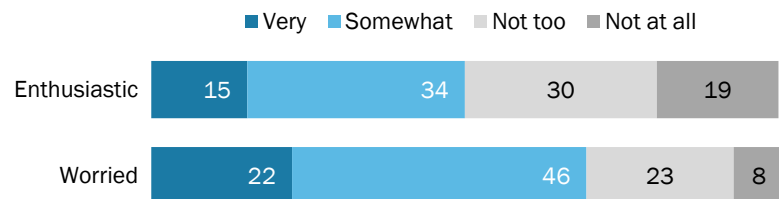
Despite some enthusiasm, the American public is largely wary about gene editing for babies

Americans have mixed emotional reactions to the possibility of using gene editing to reduce a baby's risk of serious diseases, although more people express concern rather than enthusiasm. Fully two-thirds of U.S. adults (68%) say the prospect makes them either "very" or "somewhat" worried, while roughly half (49%) say they are "very" or "somewhat" enthusiastic about this technology. Three-in-ten adults are *both* enthusiastic and worried.

Asked to consider whether they would want this kind of gene editing for their own baby, Americans are split, with 48% saying they would want to use this technology for their child and a nearly identical share saying they would not. Parents who currently have a child under age 18 are less inclined than others to say they would want this kind of gene editing for their own baby; a clear

More worry than enthusiasm about the idea of gene editing for babies

% of U.S. adults who say the possibility of gene editing to give healthy babies a much reduced risk of serious diseases makes them ...



Note: Respondents who did not give an answer are not shown.

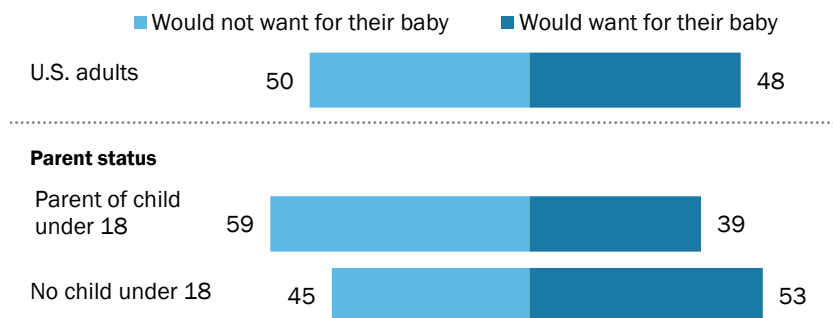
Source: Survey of U.S. adults conducted March 2-28, 2016.

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Public closely divided over whether they would want gene editing to reduce their baby's risk of disease

% of U.S. adults who say the possibility of gene editing to give healthy babies a much reduced risk of serious diseases is something they would/would not want for their baby



Note: Respondents who did not give an answer are not shown. "Definitely" would/would not want and "probably" would/would not want responses combined.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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majority of these parents (59%) would not want to use gene editing for their child.

Respondents also were asked whether they think “most people” would want to use gene-editing technology. Overall, a slim majority of Americans (55%) expect most people would want this kind of gene editing for their baby, while 42% say most people would not want this.

Those familiar with gene editing more inclined to want it for their own baby

Ideas about genetic modification and the potential for “designer babies” have been discussed among scientists, bioethicists and the broader public for some time.

When asked about their familiarity with gene editing, most Americans say they have heard either a little (48%) or a lot (9%) about this idea before, although a substantial minority (42%) had not heard anything about the possibility of gene editing before taking the survey.

Those who are at least somewhat familiar with the idea of gene editing are more inclined to say it is something they would want for their baby to reduce the child’s lifelong risk of certain serious diseases and conditions. Among those who have heard or read “a lot” or “a little” about gene-editing technology, 57% say they would want it for their child. But among those who had heard nothing at all prior to the survey, only 37% feel the same way.¹²

Most Americans have heard at least a little about gene editing

% of U.S. adults who say they have heard or read _____ about gene editing before taking the survey



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Those familiar with gene editing are more inclined to want it for their child

% of U.S. adults who say they would want gene editing for their baby to reduce risk of serious diseases, among those who said they had heard or read _____ about the topic before taking the survey



Note: Based on those who say they had heard a lot/a little or not at all about this idea. Respondents who would “definitely” or “probably” not want this or who did not give an answer are not shown. “Definitely” would and “probably” would responses combined.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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¹² The same pattern occurs among parents of minor children: 50% of those who have heard at least a little about this idea say they would definitely or probably want gene editing for their baby. This compares with 28% among parents who have not heard about this idea before.

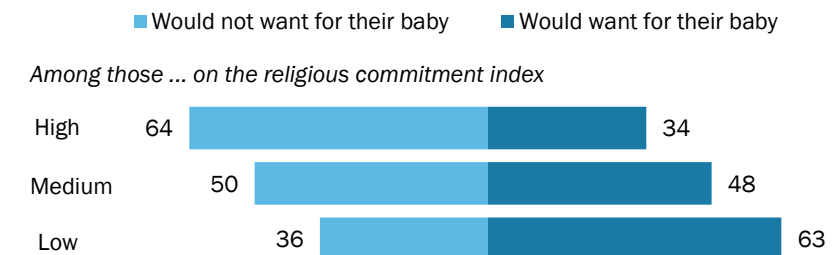
Strong religious divides in preferences about gene editing

Personal preferences about gene editing are strongly tied to differences in religious commitment and affiliation.

Respondents were classified into high, medium and low levels of religious commitment based on the self-described importance of religion in their lives, frequency of worship service attendance and frequency of prayer. A person who says religion is very important in their life and who says they attend religious services at least weekly and pray at least daily is considered to have a “high” level of religious commitment, while a person who says religion is “not too” or “not at all” important in their life and who seldom or never attends religious services or prays is placed in the “low” commitment category. All others are classified as having “medium” commitment.

Most highly religious Americans would not want gene editing for their baby

% of U.S. adults in each group who say they would/would not want gene editing giving their baby a much reduced risk of serious disease



Note: Respondents who did not give an answer are not shown. “Definitely” would/would not want and “probably” would/would not want responses combined. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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A majority of people with high religious commitment (64%) say they *would not* want gene editing for their own baby. By contrast, a nearly identical share of Americans with low religious commitment say they *would* want to use the technology for their child. Americans with a medium level of religious commitment are closely divided, with 48% saying they would want gene editing for their baby and 50% saying they would not.

There also are wide differences in feelings about gene editing by religious affiliation. White evangelical Protestants, who tend to be highly religious compared with other groups, are the least likely to want their baby to have gene editing to reduce the risk of certain serious diseases (64% would not want it).

By contrast, majorities of atheists (75%) and agnostics (67%) would want to use gene editing for this purpose. Those who say their religion is “nothing in particular” are closely divided on this question, as are Catholics (both white and Hispanic) and white mainline Protestants.

White evangelical Protestants least likely to want gene editing for babies

% of U.S. adults who say they would/would not want gene editing giving their baby a much reduced risk of serious disease

	Would want for their baby	Would not want for their baby
U.S. adults	48%	50%
Religious affiliation		
Protestant	41	56
White evangelical	33	64
White mainline	50	49
Black Protestant	43	54
Catholic	48	50
White Catholic	48	50
Hispanic Catholic	49	51
Unaffiliated	58	40
Atheist	75	24
Agnostic	67	33
Nothing in particular	50	48
Race/ethnicity		
White	50	49
Black	47	51
Hispanic	42	54

Note: Respondents who did not give an answer are not shown. “Definitely” would/would not want and “probably” would/would not want responses combined. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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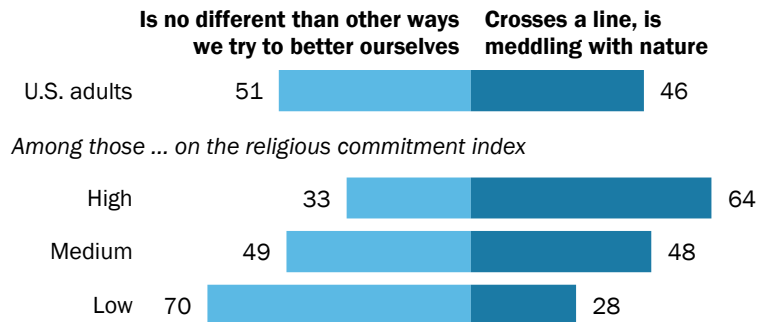
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Americans closely split on whether gene editing crosses a line that should not be crossed

The survey asked respondents whether the idea of editing genes to give healthy babies a much reduced risk of serious diseases and conditions is in keeping with other ways that humans have always tried to better themselves or whether “this idea is meddling with nature and crosses a line we should not cross.” Americans’ judgments on this question are closely divided, with 51% saying this idea is no different than other ways humans try to better themselves and 46% saying this idea crosses a line.

Most highly religious Americans say gene editing of babies would be meddling with nature

% of U.S. adults who say gene editing to give healthy babies a much reduced risk of serious diseases and conditions ...



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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As with personal preferences for gene editing, there are wide differences on this issue by religious commitment. Fully 64% of those with a high level religious commitment say the idea of gene editing for healthy babies goes too far and is meddling with nature. By contrast, seven-in-ten of those with low religious commitment say this technology is no different from other things humans do to better themselves.

A majority of white evangelical Protestants (63%) consider the idea of gene editing for healthy babies to be crossing a line that should not be crossed. Black Protestants and Catholics are more divided over this question.

Meanwhile, about eight-in-ten self-identified atheists (81%) and agnostics (80%) and roughly six-in-ten of those with no particular religious affiliation (58%) consider the idea of gene editing to be in keeping with other ways that humans try to better themselves.

Most white evangelical Protestants say gene editing crosses a line

% of U.S. adults who say gene editing to give healthy babies a much reduced risk of serious diseases ...

	Is no different than other ways we try to better ourselves	Crosses a line; is meddling with nature
U.S. adults	51%	46%
Religious affiliation		
Protestant	43	54
White evangelical	32	63
White mainline	57	41
Black Protestant	47	50
Catholic	46	52
White Catholic	46	53
Hispanic Catholic	44	55
Unaffiliated	67	31
Atheist	81	17
Agnostic	80	20
Nothing in particular	58	39
Race/ethnicity		
White	53	45
Black	51	45
Hispanic	42	54

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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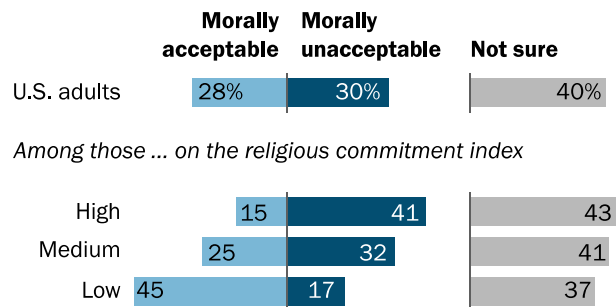
Uncertainty, divisions over moral acceptability of gene editing

There is a large degree of uncertainty among Americans about whether gene editing is morally acceptable. A plurality of Americans (40%) say they are not sure whether it would be morally acceptable or not to edit a baby's genes to give that child a reduced risk of developing serious diseases in their lifetime. Those who do express an opinion are evenly divided between those who consider gene editing for this purpose morally acceptable (28%) and those who consider it morally unacceptable (30%).

Among those with a view about this issue, there are wide differences by religious commitment. People with high religious commitment are more likely to say gene editing is morally unacceptable, while the balance of opinion leans in the opposite direction among those low in religious commitment.

Wide differences by religious commitment on whether gene editing is morally acceptable

% of U.S. adults who say gene editing to give healthy babies a much reduced risk of serious diseases is ...



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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'Designer babies' and views about genetic modification

A 2014 Pew Research Center survey asked people's views about genetically modifying babies under two circumstances: in order to reduce a baby's risk of serious diseases and conditions or to improve a baby's intelligence. U.S. adults were closely split over whether it was "an appropriate use of medical advances" (46%) or "taking medical advances too far" (50%) to modify a baby's genetic characteristics in order to reduce their risk of serious diseases. But, an overwhelming majority of adults (83%) said that modifying genetic characteristics to make a baby more intelligent was "taking medical advances too far." Those who regularly attend worship services were more likely to consider genetic modifications for either purpose to be taking medical advances too far. Another 2014 Pew Research Center survey conducted with Smithsonian Magazine on public expectations for the future found two-thirds of Americans (66%) thought the possibility of parents being able to change the DNA of their children to produce smarter, healthier or more athletic offspring would be a change for the worse; 26% said this would be a change for the better.

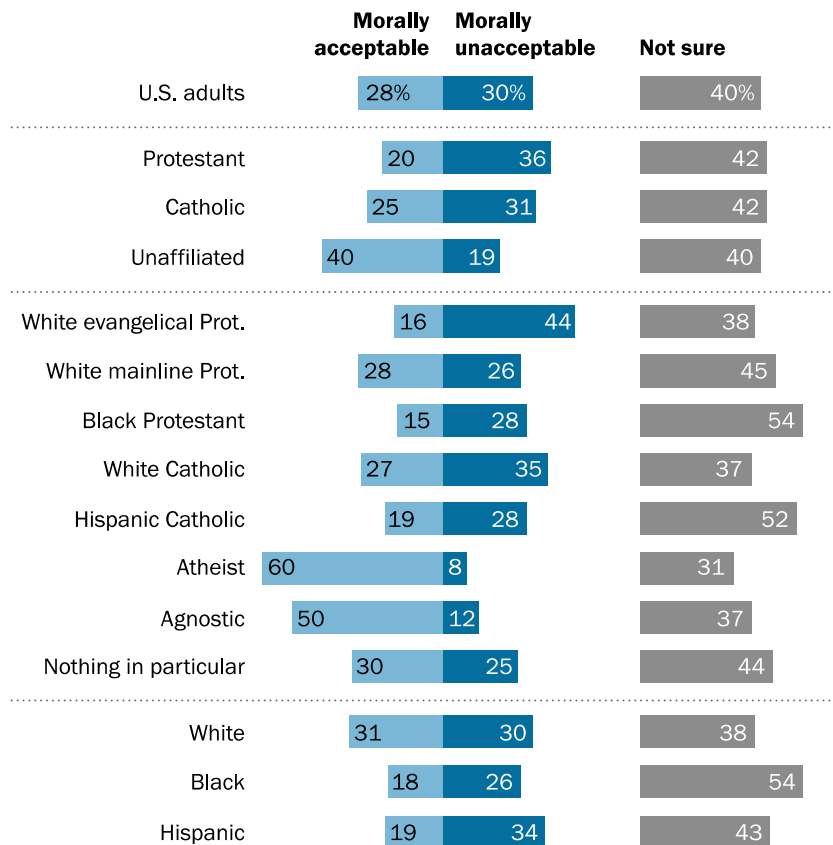
Moral judgments about gene editing also vary by religious affiliation. Relatively few white evangelical Protestants and black Protestants say it is morally acceptable; just 16% and 15%, respectively. But a majority of atheists (60%) and half of agnostics (50%) say gene editing is morally acceptable.

Atheists and agnostics, meanwhile, are unlikely to call gene editing morally unacceptable; only about one-in-ten in each group say this is the case. By contrast, 44% of white evangelical Protestants say gene editing is morally unacceptable.

Still, substantial shares across all major religious groups – including roughly half of black Protestants and Hispanic Catholics – say they are not sure whether gene editing is morally acceptable.

Moral objections to gene editing for babies is strongest among white evangelical Protestants; most atheists see this as morally acceptable

% of U.S. adults who say gene editing giving healthy babies a much reduced risk of serious diseases and conditions is ...



Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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To better understand people's thinking about these issues, the Pew Research survey asked respondents to explain, in their own words, the reasons for their moral judgments about gene editing. The most common reasons mentioned by those with moral objections to gene editing referenced a belief that it would be altering "God's plan" (34%) or that it would be going against nature or crossing a line we should not cross (26%), with some linking this idea to treating humans as a science experiment.

Other reasons Americans find gene editing to be morally unacceptable include the possibility of someone abusing the technology (9%); unintended consequences that may not be readily apparent until after implementation (8%); and the feeling that editing the genes of already-healthy people is unnatural or unnecessary (5%). Some 28% of those who say gene editing is morally unacceptable gave a different reason for feeling this way; an additional 27% did not give a reason.

Religious beliefs are prominent among reasons 30% of adults say gene editing is morally unacceptable

Respondents who said gene editing to give healthy babies a much reduced risk of serious diseases and conditions would be morally unacceptable were asked to explain, in their own words, why.

MOST COMMON RESPONSES BY CATEGORY		SAMPLE RESPONSES
References to changing God's plan	34%	"God is the Creator. Messing with the DNA is crossing the line." "We shouldn't be 'editing' what God has created to be perfect in its own way."
Disrupting nature, crossing a line we should not cross	26%	"It's messing with nature. Nothing good can come from that." "Once we begin gene editing babies, where does it end?"
Could be controlled or used for bad motives	9%	"Far too much room for misuse." "I feel this would open the door to more manipulation of humans in an attempt to create a superior race."
Could have unintended consequences	8%	"Not enough is known about manipulation of genes, which could lead to outcomes we would not be aware of or want." "Adjusting the balance in our genes could have profound and unpredictable outcomes in the way our personalities and talents develop."
Unnecessary, especially for healthy people	5%	"It is not natural." "Nobody is perfect; we all have to accept how we are born."
All other responses	28%	
Don't know/not sure	27%	

Note: Based on those who said gene editing would be morally unacceptable. Verbatim responses are coded into categories; figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Overall, 28% of U.S. adults say gene editing to give healthy babies a much reduced risk of serious diseases and conditions would be morally acceptable. The most common reasons for this point of view linked gene editing to other ways humans strive to improve themselves (32%), including some who framed this concept in terms of a moral responsibility for humans to use these tools if available and for parents to protect and improve a child's health to the greatest extent possible. Another 21% mentioned improvements to society that would stem from gene editing, such as greater safety, health and productivity.

Among the 28% of U.S. adults who say gene editing is morally acceptable, many see this concept on the continuum of human betterment

Respondents who said gene editing to give healthy babies a much reduced risk of serious diseases and conditions would be morally acceptable were asked to explain, in their own words, why.

MOST COMMON RESPONSES BY CATEGORY		SAMPLE RESPONSES
Humans are always improving and should be bettering ourselves	32%	<i>"It is just another extension of science's ability to improve our quality of life."</i> <i>"Medical advances are a moral imperative for the well-being of individuals and society."</i>
Positive effect on people and society	21%	<i>"On utilitarian grounds, the overall well-being of the population will be enhanced by this technology."</i> <i>"If used properly, it would make a huge difference to the quality of life for some people."</i>
Similar to current enhancements	8%	<i>"It is not that far from the vaccinations and other medical treatments currently in use."</i> <i>"We have intervened into many areas of natural development, this should not be an exception."</i>
God gave us the means and brains to innovate	5%	<i>"God gave us brains and tools. He expects us to use them to better people's quality of life."</i> <i>"God gave us a brain to use and better mankind."</i>
Should be free choice, up to individual	4%	<i>"As long as it is the individual mother's (and hopefully father's) choice, it is morally acceptable."</i> <i>"People should have the right to choose what is best for them and their family."</i>
All other responses	52%	
Don't know/not sure	11%	

Note: Based on those who said gene editing would be morally acceptable. Verbatim responses are coded into categories; figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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A plurality of adults –40% – is uncertain about the moral acceptability of gene editing for this purpose. While many of these respondents are simply unsure of their thinking or need more information on this issue, those who offered an explanation for their views were more likely to cite negative (53%) than positive (11%) effects of gene editing for society.

Public expects more negative than positive outcomes for society from gene editing

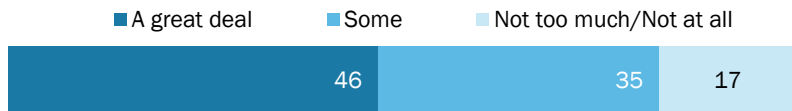
If gene editing is used to give healthy babies a reduced risk of serious diseases and conditions, Americans expect society to change. Nearly half of adults (46%) say such a development would change society “a great deal,” while 35% say it would change society “some” and just 17% say it would bring “not too much” or no change to society as whole.

A majority of U.S. adults expect the advent of gene editing could lead to widespread negative consequences for society. About three-quarters of adults (73%) say this technology would likely be used before the health effects are fully understood, and seven-in-ten say inequality would be prone to increase because gene editing would only be available for the wealthy.

A sizeable share of the public also sees the potential for positive outcomes, too, including about half who see increases in confidence for

Most Americans expect gene editing to change society

% of U.S. adults who say gene editing to give healthy babies a much reduced risk of serious diseases and conditions would change society ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

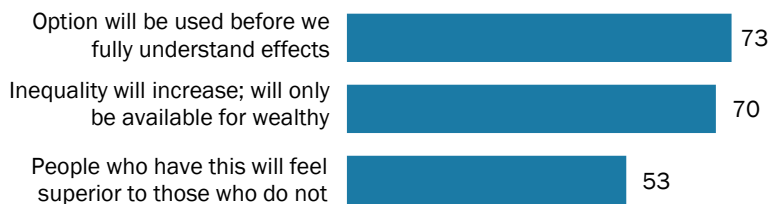
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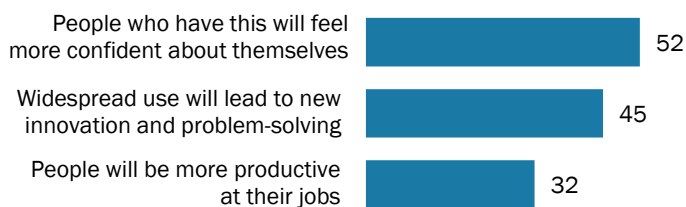
Americans expect more negative than positive effects from use of gene editing to reduce disease risk

% of U.S. adults who say _____ is likely to happen as a result of gene editing to give healthy babies a much reduced risk of serious diseases and conditions

Possible negative outcomes



Possible positive outcomes



Note: Respondents who say not likely or who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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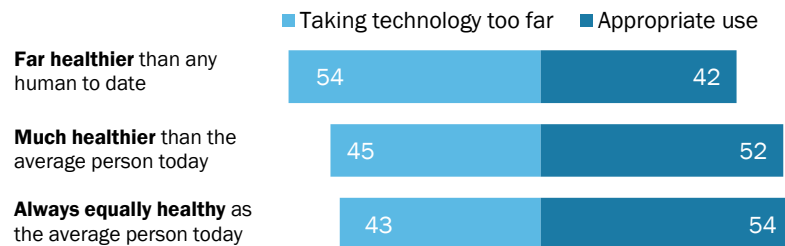
recipients of gene editing.

Acceptance of gene editing slightly higher for health effects that are less extreme

The survey asked a number of questions to tease out the way different possible extents of gene-editing technology would affect public thinking about the issue. In a hypothetical scenario in which the health effects of gene editing would make a person far healthier than any human known to date, Americans are more likely to say it would be taking the technology too far (54%) than to say it would be an appropriate use of technology (42%).

More extreme effects of gene editing are seen as taking technology too far

% of U.S. adults who say gene editing to reduce the risk of serious diseases would be appropriate/taking technology too far if it results in people ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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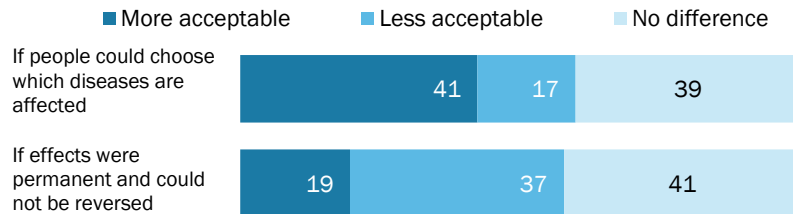
By comparison, people are more positive about gene editing when it has less-extreme health effects. In alternate scenarios in which gene editing would make a person always equally healthy to the average person today or much healthier than the average person today, Americans are somewhat more likely to see this as an appropriate use of technology than to say it is taking technology too far.

Greater acceptance of gene editing if there is control of its effects

Americans are more inclined to see gene editing that would give healthy babies a much reduced risk of serious diseases and conditions as acceptable under conditions that give those undergoing such procedures more control. For example, 41% of U.S. adults say gene editing would be more acceptable to them if people could choose which diseases and conditions are affected by the genetic modifications. By the same token, if the effects of gene editing would be permanent and irreversible, 37% of adults say gene editing would be *less* acceptable.

The ability to control gene editing's effects is more acceptable

% of U.S. adults who say gene editing giving healthy babies a much reduced risk of serious diseases would be more acceptable, less acceptable or make no difference ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

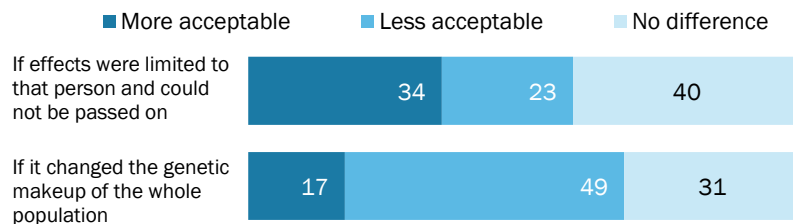
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A key concern among bioethicists stems from the potential long-term implications of a type of gene editing that could change the human gene pool, known as germline editing. A person who undergoes germline editing would pass along their modified genes to any descendants; alternatively, gene editing done only in somatic cells would not be passed on to future offspring. Asked specifically about this possibility, people are more reluctant to embrace gene editing when it could affect future generations. Roughly

Public especially concerned about germline editing

% of U.S. adults who say gene editing giving healthy babies a much reduced risk of serious diseases would be more acceptable, less acceptable or make no difference ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

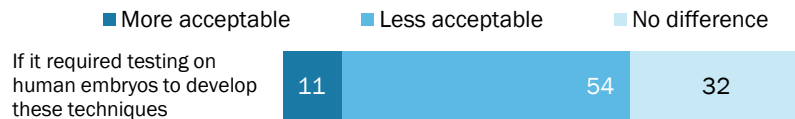
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half of adults (49%) say gene editing would be less acceptable to them if the effects “changed the genetic makeup of the whole population.” By contrast, about a third of Americans (34%) say they see an alternate scenario in which the effects of gene editing are limited to a single person as *more* acceptable.

The details of how gene editing is accomplished and assessed for this purpose are complex. According to experts, gene editing – whether for therapeutic purposes or enhancement – is likely to involve testing on human embryos. Indeed, the first research using CRISPR on human embryos was approved in the [UK as of February 2016](#). When survey respondents are asked to specifically consider the possibility that gene editing would involve testing on human embryos, most adults (54%) say this would make gene editing less acceptable to them.

Embryonic testing would make gene editing less acceptable to most Americans

% of U.S. adults who say gene editing giving healthy babies a much reduced risk of serious diseases would be more acceptable, less acceptable or make no difference ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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The more religious Americans are, the more likely they are to oppose testing of gene-editing technology on human embryos. Fully two-thirds of highly religious adults say having to test the technology on human embryos would make gene editing less acceptable to them, compared with 42% of Americans with a low level of religious commitment.

When it comes to members of different religious groups, majorities of Protestants – including two-thirds of white evangelicals – and Catholics say gene editing that involved testing on human embryos would be less acceptable to them. Half of those with no particular religious affiliation (50%) also say testing on human embryos would make gene editing less acceptable.

Gene editing less acceptable to Christians, highly religious Americans if it involves testing on human embryos

% of U.S. adults who say gene editing to give healthy babies a much reduced risk of serious diseases would be _____ if it required testing on human embryos to develop these techniques

	More acceptable	Less acceptable	No difference
U.S. adults	11%	54%	32%
Religious affiliation			
Protestant	10	59	26
White evangelical	7	66	22
White mainline	9	57	30
Black Protestant	14	53	30
Catholic	13	57	28
White Catholic	10	62	26
Hispanic Catholic	18	55	27
Unaffiliated	11	45	43
Atheist	15	35	48
Agnostic	9	39	51
Nothing in particular	10	50	39
Race/ethnicity			
White	9	55	33
Black	15	53	31
Hispanic	14	50	31
Religious commitment			
High	9	66	21
Medium	12	57	28
Low	10	42	48

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

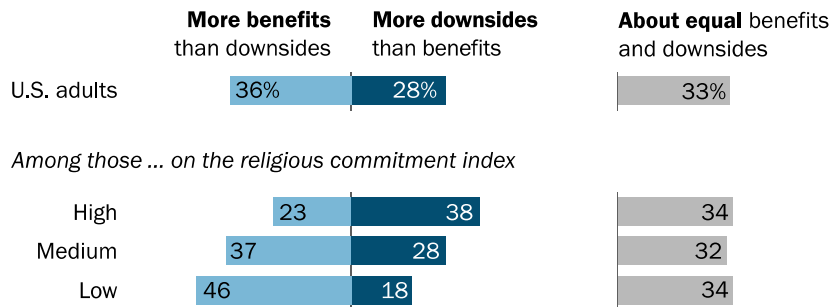
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Would benefits of gene editing outweigh downsides?

After answering a number of questions about personal reactions to this idea and the likely effects for society of gene editing for this purpose, respondents were asked for an overall take on the expected effects on society as a whole of gene editing to give healthy babies a reduced risk of serious diseases. Slightly more Americans expect the benefits for society would outnumber the downsides of gene editing (36%). But some 28% say the downsides would outpace benefits, and a third (33%) say the downsides and benefits would even out.

Negatives of gene editing outweigh positives for highly religious Americans

% of U.S. adults who say gene editing to give healthy babies a much reduced risk of serious diseases and conditions would have ...



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Those with a high level of religious commitment are more likely to say the downsides would outnumber the benefits to society than they are to say the benefits would be more numerous (38% vs. 23%). But the opposite is true of those in the low religious commitment category; 46% say the benefits would outnumber the downsides, while 18% say there would be more downsides.

About six-in-ten atheists (59%) and roughly half of agnostics (53%) say the benefits of gene editing for this purpose would outnumber the downsides for society overall, while relatively few in these groups say the downsides would be greater. People with other religious identities are more divided on this question.

Atheists and agnostics say benefits of gene editing would outweigh negatives

% of U.S. adults who say gene editing to give healthy babies a much reduced risk of serious diseases and conditions would have ...

	More benefits than downsides	More downsides than benefits	Equal benefits and downsides
U.S. adults	36%	28%	33%
Religious affiliation			
Protestant	32	30	33
White evangelical	27	36	32
White mainline	38	25	34
Black Protestant	32	29	36
Catholic	38	28	31
White Catholic	38	27	32
Hispanic Catholic	34	31	32
Unaffiliated	42	22	35
Atheist	59	14	26
Agnostic	53	12	34
Nothing in particular	33	28	38
Race/ethnicity			
White	38	27	33
Black	33	28	37
Hispanic	32	31	32

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

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3. Public opinion on the future use of brain implants

The widespread availability of brain implants might seem like an idea from science fiction, but this may not be the case for much longer. For now, brain implants, also called neuroprosthetics, are available for medical patients with specific conditions. Cochlear implants are used by hundreds of thousands of people who are deaf or hard of hearing. Thousands of patients with Parkinson's disease have a device implanted in their brain to send electrical pulses to help motor control. And, in April 2016, medical researchers from The Ohio State University and Battelle Medical Institute reported that they had helped a paralyzed patient regain control over movements of his right hand and fingers through the use of an [implanted computer chip in the brain](#). (For more details on the science behind brain implants, see "[Human Enhancement: The Scientific and Ethical Dimensions of Striving for Perfection](#).")

Surgically implanted computer chip in the brain for much improved cognitive abilities

Respondents to the Pew Research Center survey read the following statement: "New developments in understanding the brain are creating the possibility that doctors will be able to surgically implant a small computer chip in the brain. Right now, these implanted devices are being developed for people with some kind of illness or disability. But in the future, these implanted devices could potentially be available for use by *healthy* individuals, giving people a much improved ability to concentrate and process information in everyday life."

The Pew Research Center survey takes an early look at public opinion about the possibility of using similar brain implants in people *without* a specific medical need for the device. Respondents were given a brief hypothetical scenario, republished in the sidebar, involving the surgical implantation of a computer chip in the brain for the purpose of giving people a much improved ability to concentrate and process information. They were then asked a series of questions about this scenario.

Americans are much more likely to express concerns about implanting computer chips in human brains than they are to say they would be enthusiastic about such an idea. And about twice as many say they would *not* want to use this technology themselves than say they would sign up for such an implant. U.S. adults are also more likely to see this type of technology as morally unacceptable, although a considerable share say they are not sure about the moral implications. There are large differences in views about this technology among religious groups. Similar to their thoughts about gene editing, Americans who have high religious commitment are more likely to see such a device as "meddling with nature."

Americans concerned about brain implants to improve information processing

Seven-in-ten Americans say they are “very” (28%) or “somewhat” (41%) worried about the possibility of technology that would allow an implanted computer chip in the brain to give healthy people an improved ability to concentrate, but only about a third are “very” (9%) or “somewhat” (25%) enthusiastic about this prospect. A majority (64%) say they are “not too” or “not at all” enthusiastic about this potential technology.

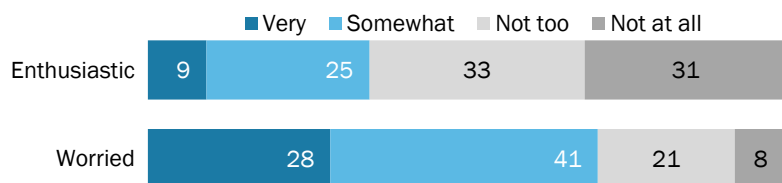
While 20% of adults are both worried and enthusiastic about this idea, many more (48%) say they are at least somewhat worried and either not too or not at all enthusiastic about this possibility.

In keeping with the widespread concern about computer chips in the brain, about two-thirds of Americans (66%) say they would not want to use this technology themselves. A third (32%) would want an implanted device that would give them a much improved ability to concentrate and process information.

Similarly, 36% of adults expect most other people would want such a device, while roughly six-in-ten (61%) say most others would not want this.

Americans are more likely to be worried than enthusiastic about implanted computer chips

% of U.S. adults who say the possibility of an implanted device for a much improved ability to concentrate and process information makes them ...



Note: Respondents who did not give an answer are not shown.

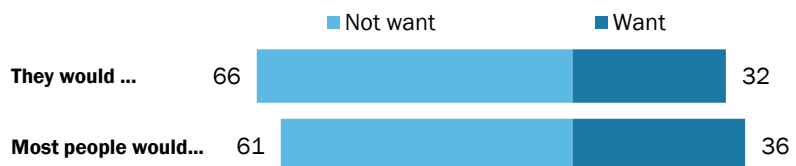
Source: Survey of U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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A minority of Americans would want an implanted computer chip to improve concentration

% of U.S. adults who say the possibility of an implanted device for a much improved ability to concentrate and process information is something ...



Note: Respondents who did not give an answer are not shown. “Definitely” would/would not want and “probably” would/would not want responses combined.

Source: Survey of U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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Those familiar with brain chip implants somewhat more inclined to want such a device

Despite some public discussion about implanted devices to treat serious medical conditions, a majority of U.S. adults (61%) say they have heard nothing at all about the idea of an implanted computer chip in the brain. About a third of Americans (32%) say they have heard a little about this, while relatively few (6%) say they have heard a lot.

Those who are more familiar with the use of implanted devices to improve brain function are more inclined to want it for themselves. Among those who had heard at least a little about this topic, four-in-ten say they would want to use such a device, compared with roughly three-in-ten (28%) of those who had heard nothing at all prior to the survey.

Most Americans have not heard about possible brain chip implants

% of U.S. adults who say they had heard or read _____ about an implanted device for much improved cognitive abilities before taking the survey



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

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Those familiar with implanted devices are more inclined to want them

% of U.S. adults who say they would want an implanted device for much improved cognitive abilities, among those who said they had heard or read _____ about the topic before taking the survey



Note: Based on those who say they had heard a lot/a little or nothing at all about this idea. Respondents who would "definitely" or "probably" not want this or who did not give an answer are not shown. "Definitely" would and "probably" would responses combined.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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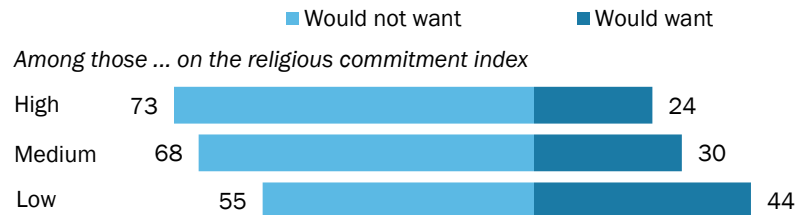
More religious Americans less likely to want a computer chip to improve brain function

As is the case with views of gene editing, personal preferences for implanted devices are correlated with religious commitment, although majorities of Americans across all religious observance levels say they would not want a chip implanted in their brain to improve cognitive function.

A large majority (73%) of those who score high on a three-item religious commitment index say they would not want this type of enhancement, compared with 24% who would want it. By comparison, 55% of those with low religious commitment say they would not want a brain chip, while 44% say they would want this. Among Americans with a medium level of religious commitment, 68% say they would not want such a device and 30% say they would want it.

Majorities across religious commitment categories would not want brain chip for themselves

% of U.S. adults in each group who say they _____ an implanted device for a much improved ability to concentrate and process information



Note: Respondents who did not give an answer are not shown. "Definitely" would/would not want and "probably" would/would not want responses combined. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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There also are large differences by religious affiliation on whether people would want an implanted computer chip in their brain. White evangelical Protestants are the least likely of all the major religious groups to say they would want an implanted device to improve their ability to concentrate and process information; 79% of white evangelical Protestants say they would not want this, while 18% say they would. Majorities of white Catholics (70%), black Protestants (69%), Hispanic Catholics (69%) and white mainline Protestants (69%) concur, saying they would not want such a device.

By comparison, atheists and agnostics are more likely to want a computer chip in their brain to improve brain function. Some 58% of atheists and roughly half (48%) of agnostics say they would sign up to receive such technology.

Majority of Christians would not want implanted devices for themselves

% of U.S. adults who say they _____ an implanted device for a much improved ability to concentrate and process information

	Would want	Would not want
U.S. adults	32%	66%
Religious affiliation		
Protestant	26	71
White evangelical	18	79
White mainline	29	69
Black Protestant	29	69
Catholic	31	68
White Catholic	29	70
Hispanic Catholic	30	69
Unaffiliated	41	57
Atheist	58	40
Agnostic	48	52
Nothing in particular	33	65
Race/ethnicity		
White	33	66
Black	32	66
Hispanic	30	67

Note: Respondents who did not give an answer are not shown. "Definitely" would/would not want and "probably" would/would not want responses combined. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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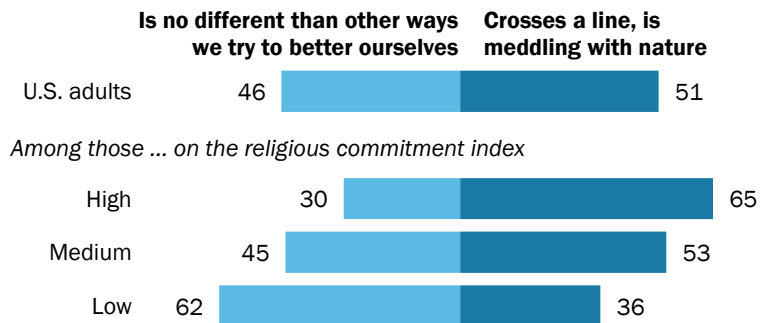
Americans closely divided over whether brain chip is meddling with nature

The survey asked respondents whether they think an implanted device to give healthy people a much improved ability to concentrate and process information would be “no different” than other ways humans try to better themselves or, rather, would be “meddling with nature and crosses a line we should not cross.” Americans are closely divided on this question, with 46% saying a computer chip implanted in the brain would be no different than other ways humans try to improve themselves and 51% saying an implanted device to improve brain function is crossing a line and meddling with nature.

Responses to this question vary by religious commitment. Americans with low religious commitment (62%) are about twice as likely as those with high religious commitment (30%) to say an implanted device is similar to other things humans do to better themselves. And those with medium religious commitment are divided on this question, much like the general public as a whole.

Most highly religious people say implanted devices to improve concentration would be meddling with nature

% of U.S. adults who say an implanted device giving healthy people much improved ability to concentrate and process information ...



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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There is also wide variation by religious affiliation on this question. White evangelical Protestants (69%) are most likely to say an implanted device crosses a line and would be meddling with nature, while atheists (72%) and agnostics (69%) are most likely to take the opposite position, saying this prospect is no different than other ways humans try to better themselves.

By comparison, Hispanic Catholics, black Protestants and those who describe their religious affiliation as “nothing in particular” are closely divided on this question.

White evangelical Protestants most likely to say implanted computer chips in the brain cross a line

% of U.S. adults who say an implanted device giving healthy people much improved cognitive abilities ...

	Is no different than other ways we try to better ourselves	Crosses a line, is meddling with nature
U.S. adults	46%	51%
Religious affiliation		
Protestant	37	59
White evangelical	25	69
White mainline	41	56
Black Protestant	47	51
Catholic	44	53
White Catholic	39	59
Hispanic Catholic	50	50
Unaffiliated	58	40
Atheist	72	27
Agnostic	69	29
Nothing in particular	50	47
Race/ethnicity		
White	44	53
Black	48	49
Hispanic	46	50

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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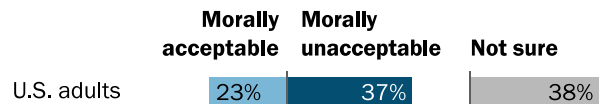
Plurality of highly religious Americans say brain chip morally unacceptable

Given that most Americans are unfamiliar with this cutting-edge medical technology, it may not be surprising that a considerable share of respondents (38%) say they are not sure whether implanting a brain chip into a healthy person to improve cognitive function would be morally acceptable. Among those who express an opinion, more say this is morally unacceptable (37%) than say it is morally acceptable (23%).

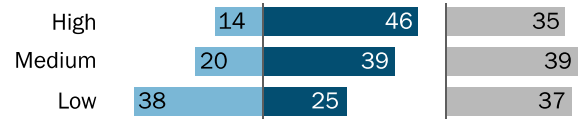
Uncertainty about the moral implications of this technology exists among people of all levels of religious commitment; a third or more of those in low, medium and high commitment categories say they are unsure whether implanting a brain chip would be morally acceptable. But among people with high levels of religious commitment, a plurality (46%) say these implanted devices would be morally unacceptable, while just 14% say they are morally acceptable. The balance of opinion among those with low religious commitment is reversed, with 38% of this group saying these implanted devices would be morally acceptable and 25% saying they would be unacceptable.

Wide differences by religious commitment on whether implanted devices are morally acceptable

% of U.S. adults who say an implanted device giving healthy people much improved cognitive abilities would be ...



Among those ... on the religious commitment index



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment

Source: Survey of U.S. adults conducted March 2-28, 2016.

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There are wide differences across religious identity groups on whether an implanted device for improved concentration and information processing would be morally acceptable or unacceptable. Just 10% of white evangelical Protestants say such a device would be morally acceptable, while half (50%) say it is morally unacceptable. The balance of opinion is the opposite among atheists, with 54% saying this technology would be morally acceptable and 16% saying it is morally unacceptable.

Sizable shares of all major religious groups, however, say they are not sure about the morality of these devices.

Half of white evangelicals say implanted devices would be morally unacceptable

% of U.S. adults who say an implanted device giving healthy people much improved cognitive abilities would be ...

	Morally acceptable 23%	Morally unacceptable 37%	Not sure 38%
U.S. adults			
Religious affiliation			
Protestant	16	43	37
White evangelical	10	50	35
White mainline	19	37	42
Black Protestant	14	38	46
Catholic	19	38	41
White Catholic	19	45	34
Hispanic Catholic	15	30	53
Unaffiliated	34	27	38
Atheist	54	16	28
Agnostic	36	20	43
Nothing in particular	27	32	39
Race/ethnicity			
White	24	37	38
Black	18	36	42
Hispanic	18	36	40

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Those who said these implanted devices would be morally unacceptable also were asked to explain why they feel this way. About one-in-five (21%) mentioned the idea that an implanted computer chip would be changing God's plan, including some respondents who cited the "mark of the beast" described in the book of Revelation in the Bible. About as many (19%) expressed the view that an implanted device would disrupt nature, crossing a line that should not be crossed. And a similar share cited a concern that these devices could be used for nefarious motives, such as being hacked and controlled by those in power (17%).

Others said this technology is morally unacceptable because it is unnecessary or because it would provide an unfair advantage to some (and perhaps exacerbate inequality).

Religious beliefs, disrupting nature are key reasons some 37% of adults say brain chip implants are morally unacceptable

Respondents who said brain chip implants giving healthy people much improved cognitive abilities would be morally unacceptable were asked to explain, in their own words, why

MOST COMMON RESPONSES BY CATEGORY		SAMPLE RESPONSES
References to changing God's plan; mark of the beast	21%	"I don't think we should mess with God's creation." "Unacceptable as I consider this 'the mark of the beast' foretold in Revelation."
Disrupting nature, crossing a line we should not cross	19%	"Planting a chip in a human begins the slippery slope of machine vs. human." "Certain things just should not be tampered with especially the brain. It is the core of a person and it is society[s] way of controlling behavior."
Could be controlled or used for bad motives	17%	"I believe that this would be a form of mind control and used by the powerful to control the masses; George Orwell's fears coming to fruition." "I think this could be abused in its use. Who controls this device and monitors its use?"
Unnecessary, especially for healthy people	13%	"This is just totally unnecessary. The beauty of human beings as a race is that we are all different and imperfect." "We are becoming lazy and trying to find ways to alter our natural state for no reason."
Would provide an unfair advantage to some	10%	"It will fracture society between the haves and have-nots." "It would create unintended biases and disadvantage [for a] normal person in the society."
All other responses	28%	
Don't know/not sure	19%	

Note: Based on those who said an implanted brain chip would be morally unacceptable. Verbatim responses are coded into categories; figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Of the 23% who think these implanted devices would be morally acceptable, one common reason given is that humans are always improving and should be bettering themselves (25%). Some 17% said such devices would be morally acceptable because the choice to have one implanted would and should be up to the individual. And another 16% say this implanted computer chip is no different from currently available enhancements that help us to achieve similar results.

Those who say brain chip implants are morally acceptable see this another human improvement

Respondents who said brain chip implants giving healthy people much improved cognitive abilities would be morally acceptable were asked to explain, in their own words, why.

MOST COMMON RESPONSES BY CATEGORY		SAMPLE RESPONSES
Humans are always improving and should be bettering ourselves	25%	"I think the advancement of the human race is something that is part of evolution and it is our moral obligation to evolve as much and as efficiently as possible." "Innovation and the betterment of human kind has been in our nature throughout history."
Should be free choice, up to individual	17%	"People make their own decisions about their bodies. Who am I to judge?" "It should be a person's choice ... no different than the effort a[n] athlete puts forth to be great, or a dieter to lose weight."
Similar to current enhancements	16%	"We don't hesitate to implant numerous devices in our bodies to improve its functioning, health and well-being (artificial joints and organs). Why not the brain?" "We already use technology to improve our cognitive functions on a daily basis, and have for years. I'm wearing glasses right now for example. This is no different."
Positive effect on people and society	10%	"Science is proven to increase people's health and lifespans. It can still be moral while helping people stay healthy." "The utilization of this technology is an opportunity to increase productivity, focus and efficiency. Improvements in these areas would not only have a positive impact on the individual who receives the implant, but would benefit society as well."
God gave us the means and brains to innovate	<1%	"I don't see this as a moral issue, just an improvement on our God given brains by scientists using their God-given brains."
All other responses	45%	
Don't know/not sure	20%	

Note: Based on those who said an implanted brain chip would be morally acceptable. Verbatim responses are coded into categories; figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Chip implants expected to bring change, but most foresee negative outcomes

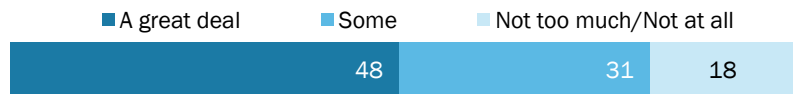
Most Americans say the use of implanted computer chips to improve cognitive function would change society either “a great deal” (48%) or “some” (31%). Just 18% of Americans say these devices would change society either “not too much” or “not at all.”

Americans are more inclined to expect negative effects from the availability of implanted computer chips to improve concentration rather than positive outcomes. Some 74% of Americans expect implanted devices will be available before their effects are fully understood. Additionally, similar shares say inequality will increase because implanted devices would be available only for the wealthy (73%) and that people who implanted devices will feel superior to those who do not (71%).

Fewer Americans, though still about half or more, foresee positive effects from implanted devices. About two-thirds (64%) say it is likely people who have computer chips in their

About half expect society to change a great deal if implanted chips become available

% of U.S. adults who say implanted devices giving healthy people much improved cognitive abilities would change society ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

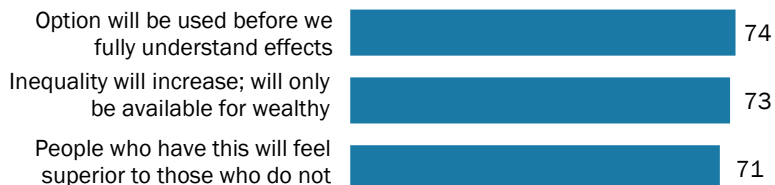
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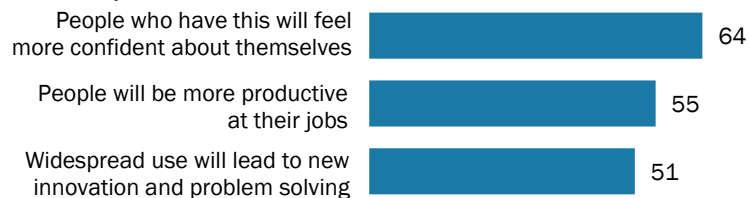
Americans more likely to expect negative than positive effects from brain chip implants

% of U.S. adults who say _____ is likely to happen as a result of implanted devices giving healthy people much improved cognitive abilities

Possible negative outcomes



Possible positive outcomes



Note: Respondents who say not likely or who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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brains will feel more confident about themselves and 55% say people will be more productive at their jobs with these devices. About half (51%) say widespread use of these devices will lead to new innovation.

Americans especially reluctant to enhance cognitive function beyond natural abilities

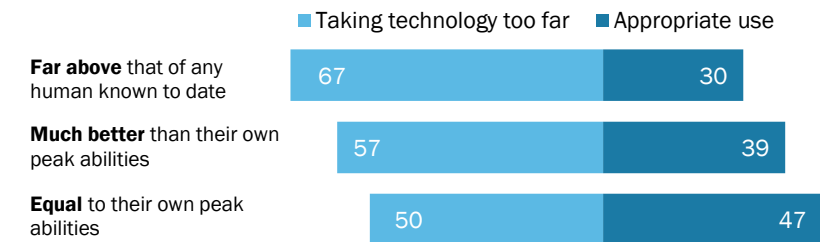
The survey sought to measure the extent to which people would be comfortable with this new human enhancement technology. Respondents were asked whether they would see the new development as “appropriate” or “taking technology too far” in a few different situations.

Americans are closely divided over whether an implanted device in the brain that gave people cognitive abilities equal to their own peak abilities is appropriate (47%) or taking technology too far (50%). But fewer (39%) say it would be an appropriate use of technology if it gave people abilities that were “much better than their own peak abilities before they had the implanted device.” And fewer

still (30%) say it would be an appropriate use of technology if these implants gave people the ability to concentrate and process information at a level far above that of any human to date.

More extreme effects of implanted devices for concentration seen as taking technology too far

% of U.S. adults who say an implanted device for improved cognitive abilities would be appropriate/taking technology too far if it made a person's abilities ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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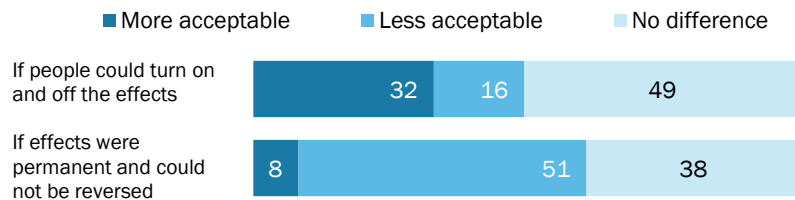
Americans more accepting of an implanted device if its effects temporary, controllable

People are more accepting of implanted devices to improve concentration if they are able to control the effects of the device.

In a hypothetical scenario in which people could turn on and off the brain-enhancing effects of an implanted chip, about a third of U.S. adults (32%) say they would find the technology more acceptable, while half as many (16%) say this condition would make it less acceptable. Meanwhile, if the effects of the implant were permanent and irreversible, fully half of Americans (51%) say it would be less acceptable to them.

Half of Americans say permanent implanted devices would be less acceptable

% of U.S. adults who say an implanted device giving healthy people much improved cognitive abilities would be more or less acceptable ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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More adults see downsides than benefits for society from brain chip implants

On balance, more Americans expect negative, rather than positive, effects for society from the prospect of an implanted device that would give healthy people much improved cognitive function.

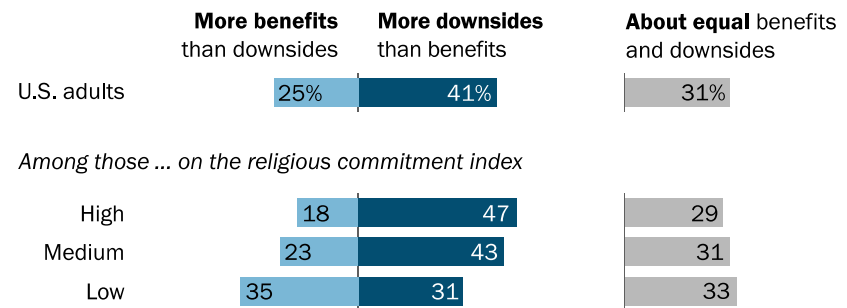
Some 41% of adults say the downsides would outnumber benefits for society, while only a quarter say the benefits would be greater. Another 31% expect the pluses and minuses to be about equal.

Those with high and medium levels of religious commitment say that, on balance, there would be more downsides than benefits for society from these implanted devices. But people with lower levels of religious commitment are more closely split, with 35% expecting

more benefits and 31% more downsides for society. A sizeable share of each religious commitment category expects benefits and downsides to be about equal.

Negatives of implanted devices outweigh positives for those with medium and high religious commitment

% of U.S. adults who say implanted devices giving healthy people much improved cognitive abilities would have ...



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Protestants and Catholics are more inclined to say the downsides of these implanted devices would outnumber the benefits. About half of white evangelical Protestants (54%) say there would be more downsides, compared with 15% saying there would be more benefits than downsides.

Among the unaffiliated, atheists are more likely to say the benefits would outpace the downsides than to say the downsides would be greater (46% vs. 22%). Agnostics are closely divided (35% say there would be more benefits and 28% say there would be more downsides). And those who say their religious affiliation is “nothing in particular” are more likely to see the downsides from this type of human enhancement as outnumbering the benefits (40% vs. 25%).

About half of white evangelical Protestants say implanted devices will have more downsides for society

% of U.S. adults who say implanted devices giving healthy people much improved cognitive abilities would have...

	More benefits than downsides	More downsides than benefits	Equal benefits and downsides
U.S. adults	25%	41%	31%
Religious affiliation			
Protestant	20	45	30
White evangelical	15	54	25
White mainline	21	38	37
Black Protestant	21	40	35
Catholic	23	42	30
White Catholic	19	41	38
Hispanic Catholic	23	48	23
Unaffiliated	31	34	32
Atheist	46	22	29
Agnostic	35	28	35
Nothing in particular	25	40	32
Race/ethnicity			
White	25	41	31
Black	24	38	35
Hispanic	23	44	26

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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4. The public's views on the future use of synthetic blood substitutes

New developments in biochemistry are creating the possibility of using a synthetic blood substitute (sometimes referred to as “super blood”) to significantly boost people’s oxygen levels in the bloodstream. With the synthetic blood substitute, a higher concentration of oxygen would be carried from the lungs to the muscles through the bloodstream and could significantly improve an individual’s physical speed, strength and stamina. This, in turn, could allow people to function in extreme conditions, or to simply perform everyday tasks with greater ease.

Synthetic blood is currently being developed mainly to help stem blood shortages for patients in need of a transfusion (see “[Human Enhancement: The Scientific and Ethical Dimensions of Striving for Perfection](#).” for more on the science behind this type of human enhancement). But the Pew Research Center survey addresses a different possibility – that synthetic blood could be used to give healthy people enhanced physical abilities. The full description of the scenario presented to survey respondents is republished in its entirety in the accompanying sidebar.

Most Americans appear skeptical about the idea of using synthetic blood substitutes in this way. For instance, most U.S. adults say they would be at least somewhat worried about this idea, and most people say they would not want to use such a product themselves. And similar to the other types of human enhancement discussed in this report, there are wide differences in views by religious commitment level, as well as by religious affiliation. Again, those who are highly religious are more likely to express the concern that this technology would be an unacceptable way of interfering with nature.

This chapter dives deeper into public views about the prospect of synthetic blood substitutes that would give healthy people much improved physical capabilities.

Synthetic blood substitute for much improved physical abilities

Respondents to the Pew Research Center survey read the following statement: “New developments are creating the possibility of using synthetic blood substitutes to increase the oxygen level in a person’s bloodstream, giving them increased speed, strength and stamina. Right now, this man-made substitute for blood is being developed for people with some kind of illness or medical condition. But in the future, a transfusion with this kind of synthetic blood substitute could be developed for use by *healthy* individuals, giving people a much improved ability to complete all sorts of tasks with much greater speed, strength and stamina.”

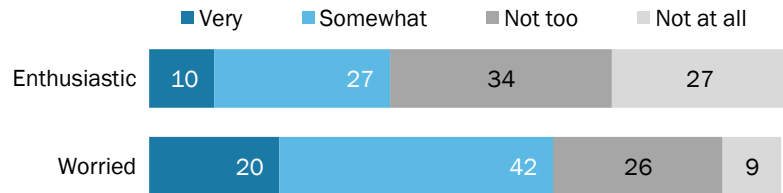
Public more negative than positive about synthetic blood substitutes

About a third of U.S. adults say they would be enthusiastic about the possibility of a synthetic blood substitute, including 10% who would be “very” enthusiastic and 27% who are “somewhat” enthusiastic. But many more people say they would be very (20%) or somewhat (42%) worried about the prospect of “super blood.” Roughly one-in-five (21%) Americans say they are both enthusiastic and worried about this technology.

When asked whether synthetic blood is something they would want for themselves, roughly a third of U.S. adults (35%) say yes, but a majority (63%) would *not* want synthetic blood in their own body. Respondents were also asked whether they expect “most people” would want this. A slim majority (53%) expect most people would *not* want to use this technology to increase their speed, strength and stamina, while 44% think most people would like to have synthetic blood for this purpose.

Americans are more likely to be worried than enthusiastic about synthetic blood

% of U.S. adults who say the possibility of a synthetic blood substitute giving healthy people much greater speed, strength and stamina makes them ...



Note: Respondents who did not give an answer are not shown.

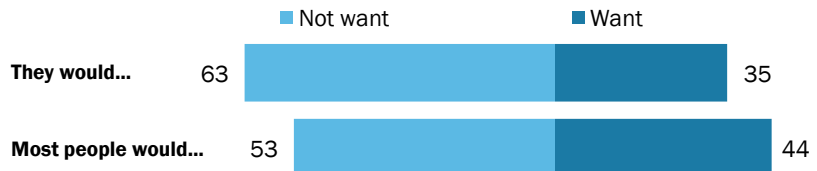
Source: Survey of U.S. adults conducted March 2-28, 2016.

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A minority of Americans would want synthetic blood for improved physical abilities

% of U.S. adults who say a synthetic blood substitute for much greater speed, strength and stamina is something ...



Note: Respondents who did not give an answer are not shown. “Definitely” would/would not want and “probably” would/would not want responses combined.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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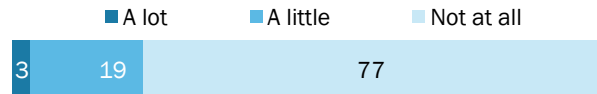
Those familiar with synthetic blood more likely to want it for themselves

The idea of “blood doping” – which uses a variety of techniques to boost oxygen levels, including the injection of substances such as erythropoietin and the removal and re-injection of one’s own blood – has been a topic of concern in professional sports. But when it comes to synthetic blood substitutes, a large majority of respondents (77%) say they had heard nothing at all about the idea of using this to boost physical abilities before taking the survey.

Among those who have heard at least a little about synthetic blood, nearly half (48%) say it is something they would want for themselves. This is larger than the share of those who had previously heard nothing about this technology who say the same (32%). A similar pattern is seen on all three types of human enhancement discussed in the survey.

A minority of adults have heard or read about synthetic blood substitutes

% of U.S. adults who say they have heard or read _____ about synthetic blood substitutes before taking the survey



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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Those familiar with synthetic blood are more inclined to want it

% of U.S. adults who say they would want a synthetic blood substitute for much greater speed, strength and stamina, among those who said they had heard or read _____ about the topic before taking the survey



Note: Based on those who say they had heard a lot/a little or not at all about this idea. Respondents who would “definitely” or “probably” not want this or who did not give an answer are not shown. “Definitely” would and “probably” would responses combined.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Majorities across religious commitment categories would not want blood substitute

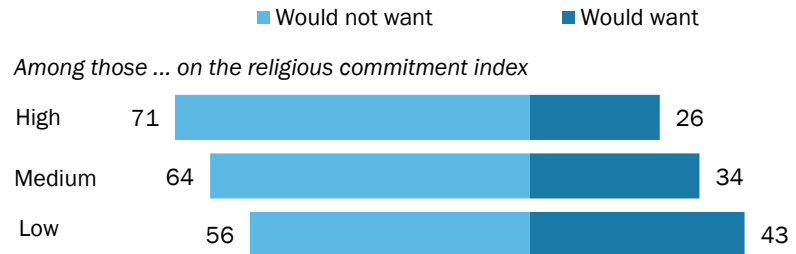
Highly religious people tend to be more opposed to the idea of using the possible enhancements mentioned in the survey, and synthetic blood is no exception. Those with lower levels of religious commitment are more likely than those who are highly religious to say they would want synthetic blood for themselves (43% vs. 26%).

But majorities of all three religious commitment categories say they would *not* want to use synthetic blood themselves. Among those on the low end of the three-

measure religiosity scale (determined by frequency of worship service attendance, frequency of prayer and self-described importance of religion), 56% say they would not want the blood substitute. And among the highly religious, fully 71% say they would not want synthetic blood. Those whose level of religiosity falls in the middle closely mirror the general public on this issue.

Fewer among the highly religious would want synthetic blood to improve physical abilities

% of U.S. adults in each group who say they ____ a synthetic blood substitute for much greater speed, strength and stamina



Note: Respondents who did not give an answer are not shown. "Definitely" would/would not want and "probably" would/would not want responses combined. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Majorities of all major Christian groups say they would not want to use a synthetic blood substitute that would give them greater speed, strength and stamina. This includes two-thirds or more of black Protestants (66%), white Catholics (68%), white mainline Protestants (68%) and white evangelicals (72%).

The religiously unaffiliated, overall, also lean toward not wanting a synthetic blood substitute (57% would not want it, vs. 42% who would). But atheists and agnostics are more narrowly divided over whether they would want this technology. By contrast, those who say their religion is “nothing in particular” fall clearly in the “would not want” camp.

Majorities of most religious groups say they would not want synthetic blood

% of U.S. adults who say they would/would not want a synthetic blood substitute for much greater speed, strength and stamina

	Would want	Would not want
U.S. adults	35%	63%
Religious affiliation		
Protestant	29	68
White evangelical	25	72
White mainline	30	68
Black Protestant	31	66
Catholic	35	63
White Catholic	32	68
Hispanic Catholic	39	57
Unaffiliated	42	57
Atheist	54	45
Agnostic	45	55
Nothing in particular	37	61
Race/ethnicity		
White	34	64
Black	35	63
Hispanic	38	59

Note: Respondents who did not give an answer are not shown. “Definitely” would/would not want and “probably” would/would not want responses combined. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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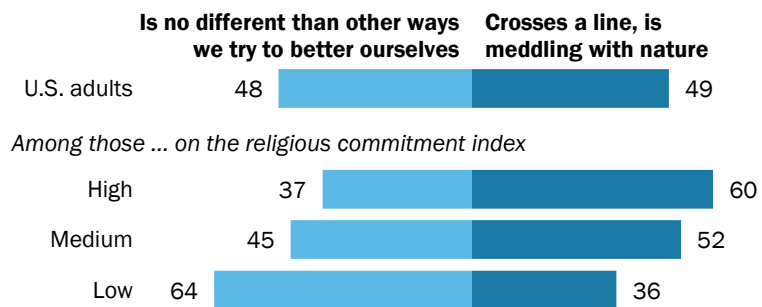
Americans closely divided over whether synthetic blood is different from other forms of human betterment

The U.S. public overall is closely split between those who say using synthetic blood to increase speed, strength and stamina would be no different than other ways humans try to better themselves (48%) and those who say it is meddling with nature and crosses a line that should not be crossed (49%).

Most of those who display a low level of religious commitment (64%) say synthetic blood is similar to other ways humans try to better themselves. But the balance of opinion is flipped among those who are highly religious. Six-in-ten highly religious people (60%) say the use of “super blood” meddles with nature and crosses a line that should not be crossed, while 37% say the technology is no different than other methods of human enhancement.

Most highly religious adults say synthetic blood substitute is meddling with nature

% of U.S. adults who say a synthetic blood substitute giving healthy people much greater speed, strength and stamina ...



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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There is wide variation of opinion on this question across religious groups. At one end of the spectrum, most white evangelical Protestants (65%) and white Catholics (60%) believe that a synthetic blood substitute would cross a line that should not be crossed. By contrast, 77% of self-described atheists and 72% of agnostics say synthetic blood is no different than other ways of humans have sought to better themselves over the years.

Much like the general public, white mainline Protestants, black Protestants and Hispanic Catholics are all closely divided on this question.

White evangelical Protestants and white Catholics most likely to say synthetic blood substitutes cross a line

% of U.S. adults who say a synthetic blood substitute giving healthy people much greater speed, strength and stamina ...

	Is no different than other ways we try to better ourselves	Crosses a line, is meddling with nature
U.S. adults	48%	49%
Religious affiliation		
Protestant	41	56
White evangelical	31	65
White mainline	46	51
Black Protestant	49	48
Catholic	44	52
White Catholic	39	60
Hispanic Catholic	47	45
Unaffiliated	60	39
Atheist	77	22
Agnostic	72	28
Nothing in particular	50	48
Race/ethnicity		
White	48	50
Black	51	46
Hispanic	47	47

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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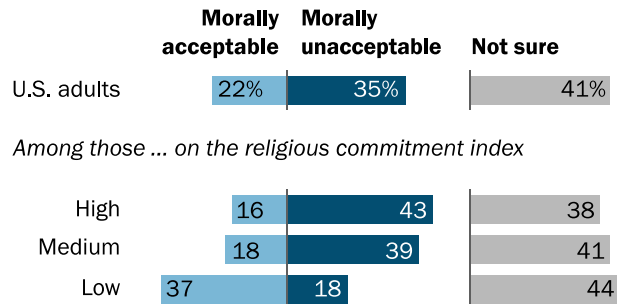
Many Americans unsure about morality of synthetic blood; more say it is morally unacceptable than acceptable

Americans overall are more likely to find synthetic blood morally unacceptable (35%) than to find it acceptable (22%). But much like reactions to the morality of the other types of human enhancement explored in this survey, a substantial share of U.S. adults – in this case, a 41% plurality – say they are not sure about the moral implications of using synthetic blood to give healthy people improved physical abilities.

Among highly religious Americans, more say synthetic blood is morally unacceptable than acceptable (43% vs. 16%). By contrast, those with a low level of religious commitment are twice as likely to find this technology morally acceptable than unacceptable (37% vs. 18%).

Wide differences by religious commitment on whether synthetic blood is morally acceptable

% of U.S. adults who say a synthetic blood substitute giving healthy people much greater speed, strength and stamina would be ...



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

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Members of all major Christian groups are more likely to say using a synthetic blood substitute would be morally *unacceptable* than to say it would be acceptable. White evangelical Protestants and black Protestants are roughly four times as likely to see this technology as morally unacceptable as they are to say it is acceptable. White mainline Protestants and white Catholics lean in the same direction, but by about a two-to-one margin.

But at the same time, large shares of many groups say they are not sure about the morality of this potential technology. For instance, a *majority* of black Protestants (58%) are unsure about whether synthetic blood would be morally acceptable.

By contrast, fully half of atheists (53%) say using synthetic blood would be morally acceptable, while just 11% say it would not be OK. And agnostics are twice as likely to say this type of human enhancement would be acceptable (35%) vs. unacceptable (17%); however, about half of agnostics (48%) are not sure about this.

More Christians say use of synthetic blood is morally unacceptable than acceptable

% of U.S. adults who say a synthetic blood substitute giving healthy people much greater speed, strength and stamina would be ...

	Morally acceptable	Morally unacceptable	Not sure
U.S. adults	22%	35%	41%
Religious affiliation			
Protestant	15	39	43
White evangelical	12	46	39
White mainline	16	35	47
Black Protestant	9	30	58
Catholic	19	39	40
White Catholic	19	44	36
Hispanic Catholic	19	36	45
Unaffiliated	32	24	42
Atheist	53	11	35
Agnostic	35	17	48
Nothing in particular	25	31	43
Race/ethnicity			
White	23	35	40
Black	14	31	53
Hispanic	21	36	42

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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The 35% of Americans who say synthetic blood would be morally unacceptable were also asked to explain why they feel this way. The most common concerns were that blood substitutes would disrupt nature and cross a line (25%), that this technology would be a form of trying to “play God” or that blood is religiously sacred (20%), and that blood substitutes seem unnecessary, especially for healthy people (17%).

Disruption of nature, God’s plan are key reasons some 35% of adults say synthetic blood substitutes are morally unacceptable

Respondents who said synthetic blood substitutes for much greater speed, strength and stamina would be morally unacceptable were asked to explain, in their own words, why.

MOST COMMON RESPONSES BY CATEGORY		SAMPLE RESPONSES
Disrupting nature, crossing a line we should not cross	25%	“It’s messing with the laws of nature and the laws of ethics.” “It’s crossing a line that humans should not cross. Just because science helps us to do things doesn’t mean that we should. There is a reason why Earth has lasted so long without man’s influence.”
References to changing God’s plan	20%	“It is very morally unacceptable. Doctors, scientists and government are trying to play God and they are NOT.” “The Bible states that ‘life is in the blood.’ I do not think synthetic blood is a good idea; like people are trying to play God.”
Unnecessary, especially for healthy people	17%	“I think it is completely unnecessary for a healthy person.” “I do not think we need foreign blood in our bodies, who knows what will happen.”
Could be used for bad motives	10%	“These kinds of supposed ‘improvements’ always lead to humans abusing something that was meant for good.” “Should be used only in cases of medical necessity. Not for the general public. Sounds too much like trying to create a master race.”
Would provide an unfair advantage to some	10%	“It is a form of cheating.” “It will give those who can afford it an edge not available to others so it keeps the playing field unlevel.”
All other responses	36%	
Don’t know/not sure	18%	

Note: Based on those who said synthetic blood would be morally unacceptable. Verbatim responses are coded into categories; figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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Among the one-in-five U.S. adults (22%) who say synthetic blood substitutes for healthy people are morally acceptable, a quarter explained their reasoning by linking the technology to a broader, positive idea of human progress. Others (19%) said this type of enhancement is OK because it is similar to other kinds of enhancements that are already available, while 16% cited its potential positive effect on society. Some 12% of adults who see synthetic blood as morally acceptable said free choice and each person's control over their own body explains their perspective.

Those who say synthetic blood substitutes are morally acceptable see this as continuing human innovation

Respondents who said synthetic blood substitutes for much greater speed, strength and stamina would be morally acceptable were asked to explain, in their own words, why.

MOST COMMON RESPONSES BY CATEGORY		SAMPLE RESPONSES
Humans are always improving and should be bettering ourselves	25%	<i>"Biomedical advances are the next logical step in human progress."</i> <i>"Many scientific advances seemed shocking at first, but are now routine."</i>
Similar to current enhancements	19%	<i>"It's a choice that is available to improve your lifestyle like cosmetic surgery, braces, implants...It's simply an option."</i> <i>"I see it as a developed advantage, no different than wearing shoes or using tools."</i>
Positive effect on people and society	16%	<i>"Advances in science help society as a whole."</i> <i>"Anything that will improve health is better for society."</i>
Should be free choice, up to individual	12%	<i>"It's morally acceptable because it's people's choice what to put in their bodies as long as there's clear understanding and informed consent."</i> <i>"People should have the right to do what they wish with their bodies."</i>
God gave us the means and brains to innovate	3%	<i>"God created humans to always try to better ourselves."</i> <i>"I feel that this is morally acceptable because God has given man the ability to create this improvement in his physical condition."</i>
All other responses	57%	
Don't know/not sure	11%	

Note: Based on those who said synthetic blood would be morally acceptable. Verbatim responses are coded into categories; figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

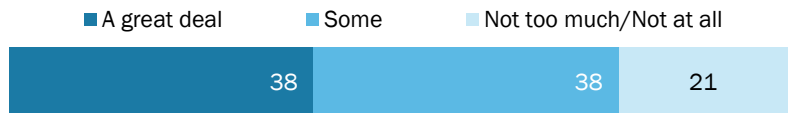
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Most expect enhancement using synthetic blood to bring negative effects for society

Fully three-quarters (76%) of U.S. adults anticipate at least some change to society should a synthetic blood substitute become available to enhance the physical abilities of healthy people. This includes equal shares of people who say society will change “a great deal” and those who say there will be just “some” change (38% each).

About four-in-ten expect society to change a great deal if synthetic blood becomes available

% of U.S. adults who say a synthetic blood substitute giving healthy people much greater speed, strength and stamina will change society...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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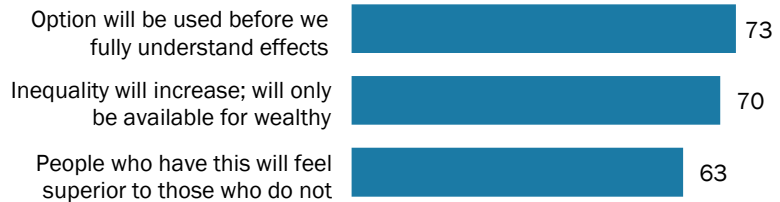
In general, U.S. adults are more likely to expect negative, rather than positive, outcomes as a result of using “super blood.” Some 73% say it is likely that synthetic blood will be used before the effects are fully understood. And 70% say it will increase inequality because this technology will be available only for the wealthy.

At the same time, most adults think those who have this synthetic blood substitute will feel more confident and better about themselves (61%). But fewer think synthetic blood will lead to greater work productivity (46%) or new innovation (39%).

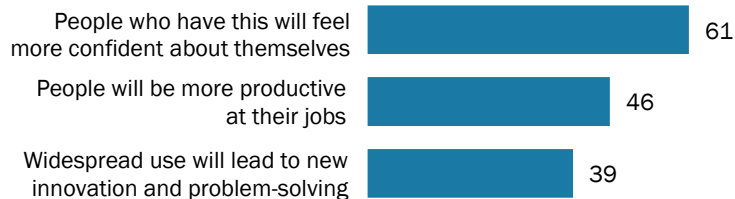
Public expects more negatives than positives from synthetic blood

% of U.S. adults who say each of the following is likely to happen as a result of a synthetic blood substitute giving healthy people much greater speed, strength and stamina

Possible negative outcomes



Possible positive outcomes



Note: Respondents who say not likely or who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

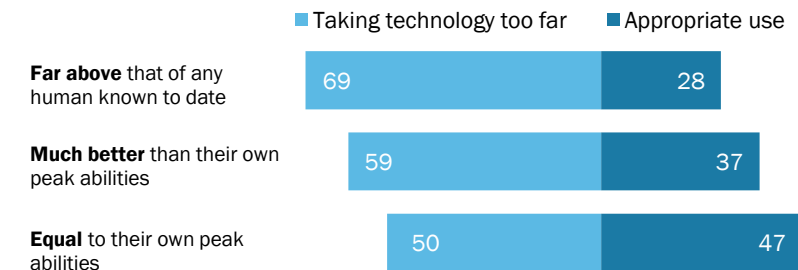
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Acceptance of synthetic blood is somewhat higher when effects are on a par with current physical abilities

On all three types of human enhancement mentioned in the survey, there is a pattern that the more extreme the effects of the hypothetical new technology, the less acceptance there is of that technology. When it comes to using synthetic blood to increase speed, strength and stamina in healthy people, Americans are closely divided on whether this is appropriate or “taking technology too far” if the blood substitute were to make a person’s abilities equal to their own natural, peak abilities.

More extreme effects of synthetic blood are seen as taking technology too far

% of U.S. adults who say a synthetic blood substitute for greater speed, strength and stamina would be appropriate/taking technology too far if it made a person’s abilities ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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But there is more opposition in more extreme scenarios. The survey asked whether the technology would be acceptable if it were to make a person’s abilities “much better than the average person today” or “far above that of any human to date.” In this first, “much better,” scenario, a clear majority (59%) of Americans say this would be taking technology too far. And if synthetic blood were to make a person’s abilities “far above that of any human to date,” nearly seven-in-ten (69%) say this is too much, while only 28% say it is an appropriate use of technology.

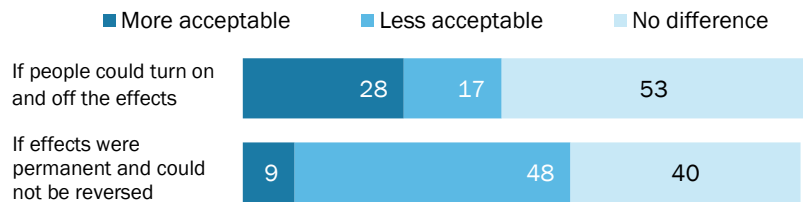
Lower public acceptance of synthetic blood if effects were to be permanent

The amount of human control over the effects of synthetic blood also plays a role in how acceptable people find the idea. In a scenario in which the technology would be controllable – that is, the recipient could turn the effects of the synthetic blood on and off – 28% of adults say the technology would be more acceptable to them. Just 17% say this would be less acceptable in their eyes, and most respondents say it makes no difference (53%).

By contrast, if the effects of a synthetic blood transfusion were permanent, a plurality of U.S. adults (48%) say this option would be less acceptable.

About half of Americans say synthetic blood with permanent effects would be less acceptable

% of U.S. adults who say a synthetic blood substitute giving healthy people much greater speed, strength and stamina would be more or less acceptable...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

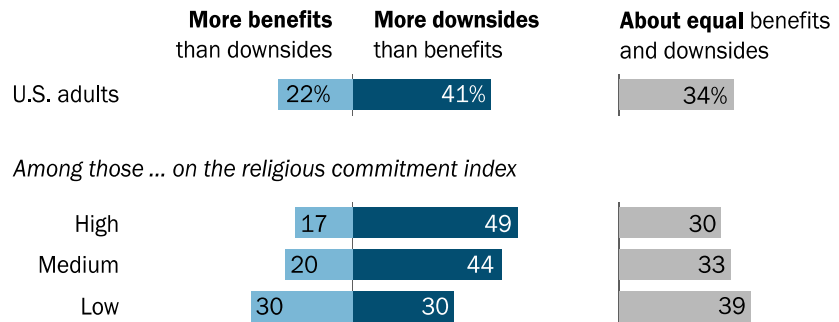
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After considering the possible effects and outcomes of using a synthetic blood substitute for healthy people, a plurality of U.S. adults (41%) conclude that this technology would ultimately have more downsides for society than benefits. About a fifth (22%) say there would be more benefits than downsides, and a third (34%) judge that the pros and cons would be about equal.

Among those who are highly religious, nearly half (49%) say the downsides would outweigh any benefits; just 17% take the opposite view. Those with low levels of religious commitment are evenly split: 30% say the benefits would outweigh the downsides, and an equal share says the downsides would be greater.

Negatives of synthetic blood outweigh positives for all but least religious Americans

% of U.S. adults who say a synthetic blood substitute giving healthy people much greater speed, strength and stamina would have ...



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

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Within every major Christian group, more people express the opinion that using a synthetic blood substitute to boost a healthy individual's speed, strength and stamina would have more downsides for society than say the benefits would be greater. Among white evangelical Protestants, for example, fully half say downsides would be more prevalent, while just 14% say benefits would win out.

Even among the religiously unaffiliated, the balance of opinion falls toward the downsides outweighing the benefits (34% vs. 26%).

However, there are stark differences between atheists and those who say their religion is “nothing in particular.” Among atheists, 42% expect synthetic blood to bring more benefits for society than downsides (compared with the 19% who say downsides will win out). By contrast, among those who say they have no particular religion, those figures are roughly flipped: 44% expect the downsides to outweigh the benefits and 20% say society will experience more benefits than downsides with this technology in play.

White evangelical Protestants among most likely to say synthetic blood substitutes will have more downsides than benefits for society

% of U.S. adults who say a synthetic blood substitute giving healthy people much greater speed, strength and stamina would have...

	More benefits than downsides	More downsides than benefits	Equal benefits and downsides
U.S. adults	22%	41%	34%
Religious affiliation			
Protestant	19	44	33
White evangelical	14	50	31
White mainline	19	42	36
Black Protestant	21	39	36
Catholic	19	42	34
White Catholic	16	42	39
Hispanic Catholic	24	45	28
Unaffiliated	26	34	37
Atheist	42	19	39
Agnostic	31	25	44
Nothing in particular	20	44	34
Race/ethnicity			
White	21	41	35
Black	22	38	36
Hispanic	25	40	31

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey conducted March 2-28, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

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5. From plastic surgery to vasectomies: Public opinion on current human enhancement options

While some types of potential human enhancements may seem like science fiction to observers not immersed in the world of biotechnology, there are any number of enhancements already available to the general public today. From laser eye surgery to teeth whitening, modern human enhancements are widely known today.

The theme of “everyday enhancements” arose first in the series of [focus group discussions](#) Pew Research Center held as part of the development of this survey. As people thought through the possibility of using cutting-edge enhancements such as gene editing, brain chip implants or synthetic blood in the future, many also drew connections to cosmetic surgery and other kinds of enhancements widely available today.

As a point of comparison, the survey also included a series of questions about the kinds of procedures people can undergo today.¹³

The survey finds most Americans express a “go slower” reaction to the kinds of enhancements widely available today, mirroring some of the concerns expressed about future possibilities. But at least half of Americans – and in some cases, large majorities – say each of six kinds of enhancement procedures (ranging from surgery to prevent conception to eye surgery to elective cosmetic surgery) is an appropriate use of technology.

As with future possibilities for human enhancement, public views about cosmetic and other enhancements widely available today are tied to religious commitment. However, the magnitude of differences by religious commitment and religious affiliation on these types of procedures is relatively modest, by comparison with views about potential enhancements available in the future.

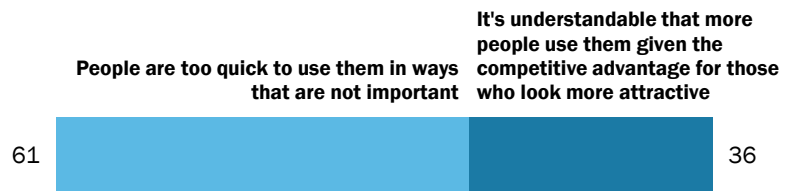
¹³ These questions were asked in a survey conducted about a month later than the main survey covering gene editing, implanted devices and synthetic blood substitutes. See [Methodology](#) for details.

Most Americans say people are too quick to use cosmetic procedures today

Respondents were asked which statement is closer to their view: that “people are too quick to undergo cosmetic procedures in order to change their appearance in ways that are not really important,” or that “it’s understandable that more people undergo cosmetic procedures these days because it’s a competitive world and people who look more attractive tend to have an advantage.” Most U.S. adults (61%) choose the first, more negative statement, while 36% say cosmetic procedures are understandable.

Public opinion mostly negative on use of cosmetic procedures today

% of U.S. adults who say the following about cosmetic procedures



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

“U.S. Public Wary of Biomedical Technologies to ‘Enhance’ Human Abilities”

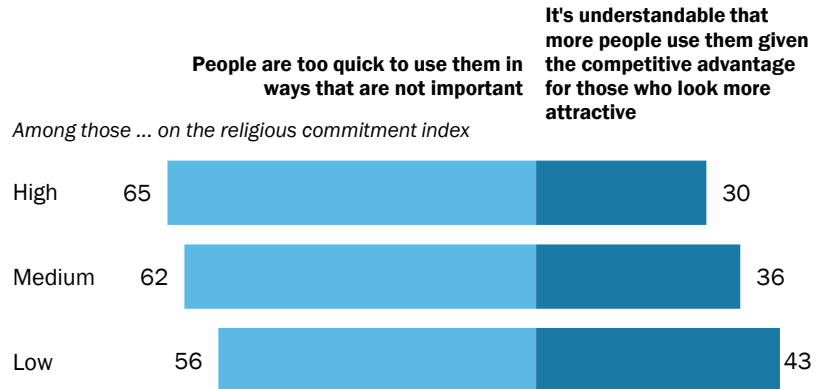
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There are modest differences in views about the use of cosmetic procedures by religious commitment. This pattern aligns with the much stronger differences by religious commitment about potential use of cutting-edge technologies considered in earlier chapters of this report. Some 65% of those in the “high” religious commitment category say “people are too quick to undergo cosmetic procedures,” compared with 56% of those with a low level of religious commitment.

There are only small differences across religious tradition on this question. Most members of all major religious groups, including those with no religious affiliation, say people are too quick to undergo cosmetic procedures in ways that are not really important.

Highly religious Americans especially likely to say people are too quick to undergo cosmetic procedures

% of U.S. adults in each group who say _____ about cosmetic procedures



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

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Many people have at least indirect experience with enhancement procedures

To gauge familiarity with enhancements available today, the survey asked respondents whether they ever had any of several kinds of procedures, including elective cosmetic surgery, laser eye surgery, skin or lip injections, cosmetic dental procedures, hair replacement surgery or vasectomy/tubal ligation procedures. Altogether, about three-in-ten Americans (31%) have had at least one of these six procedures, and most adults (58%) know a close friend or family member who has had one or more.

Most of these procedures are cosmetic in nature, while two are not: contraceptive surgery and laser eye surgery.

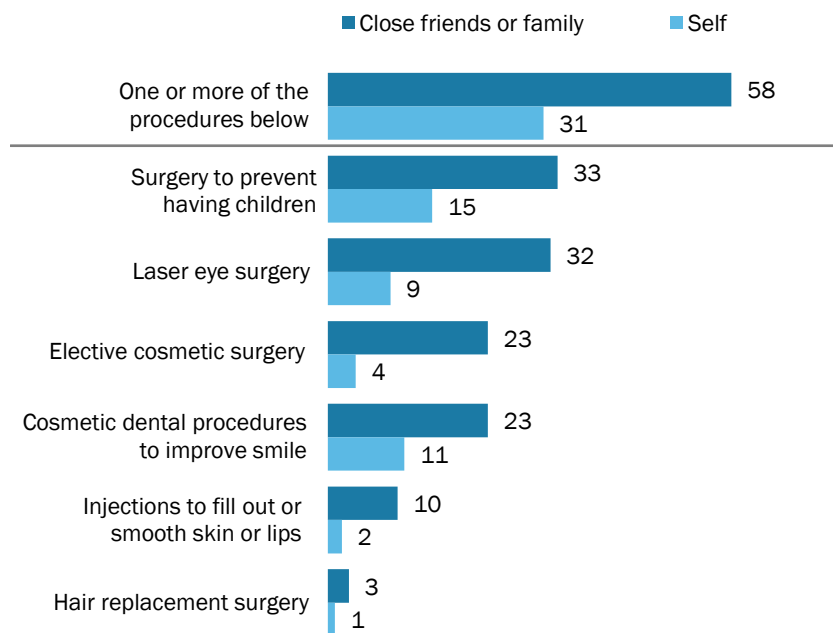
Tubal ligation and vasectomy are akin to some of the potential future enhancements in that they involve a surgical procedure with a specific aim – in this case, contraception. A third of adults have a close friend or family member who has had this surgery, while 15% of adults say they have had either a vasectomy or tubal ligation procedure themselves.

Laser eye surgery, another procedure typically classified as an elective, cosmetic procedure, is included in this context because it is a bodily change aimed at enhancing one's natural vision. Some 9% of adults report having had

laser eye surgery themselves, while 32% have a close friend or family member who has done so.

31% of Americans have had an 'enhancing' procedure; most have a close friend or family member who has

% of U.S. adults who say either they or a close friend or family member has had each of the following



Note: Respondents who have not had or who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

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About one-in-ten Americans (11%) also report having had cosmetic dental procedures to improve their smile, while smaller shares say they have had elective cosmetic surgery (4%), skin or lip injections (2%) or hair replacement surgery (1%).

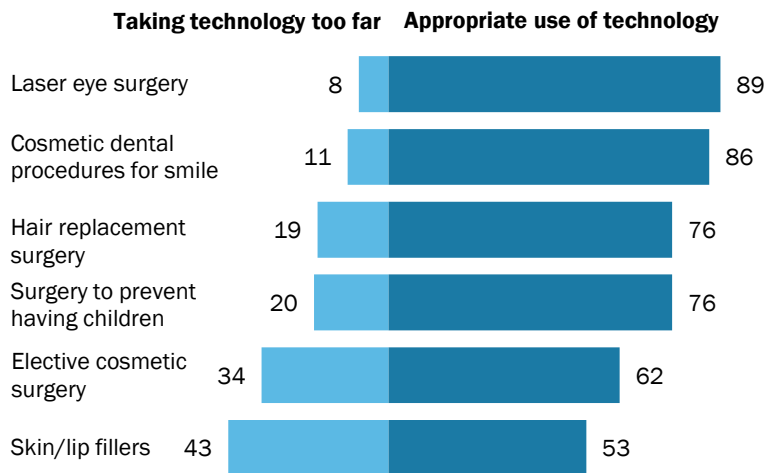
As one might expect, direct experience with these procedures tends to vary by gender, income and age. Some 38% of women and 24% of men say they have had one or more of the six procedures. Four-in-ten (39%) of those with family incomes of \$150,000 or higher have had at least one of these procedures, compared with 26% among those with family incomes under \$30,000 annually. Personal experience with the six procedures also is more common among older adults; 40% of those ages 65 and older have had at least one of the procedures, compared with 19% among adults ages 18 to 29.

For the most part, Americans say each of these six procedures is an appropriate use of technology. Some 89% say laser eye surgery is an appropriate use of technology, while just 8% say this is taking technology too far. A similarly large majority (86%) say cosmetic dental procedures to improve one's smile are an appropriate use of technology, while 76% say the same about both hair replacement surgery and vasectomy or tubal ligation surgery.

A smaller majority (62%) says elective cosmetic surgery is an appropriate use of technology, and a slim majority (53%) says this about the use of skin and lip fillers (such as Botox or hyaluronic acid).

Most Americans say enhancements available today are an appropriate use of technology

% of U.S. adults who say _____ is an appropriate use of technology/takes technology too far



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

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Differences by education and income are apparent in people's views about the enhancements available today, particularly between those at the lowest levels of income and education compared with those in the middle and higher levels.

People with incomes of \$75,000 or higher are particularly likely to say each of these six types of enhancements is an appropriate use of technology.¹⁴ For instance, 78% of Americans in this income bracket say elective cosmetic surgery is an appropriate use of technology, compared with just half (49%) of those with family incomes under \$30,000 – a gap of 29 percentage points.

Differences by educational attainment follow a similar pattern. For example, those with a college or postgraduate degree are more likely than adults with a high school degree or less schooling to say surgery to prevent pregnancy is an appropriate use of technology (86% vs. 65%).

More in higher income, education groups see today's enhancements as appropriate

% of U.S. adults in each income/education group who say _____ is an appropriate use of technology

	---Family income---			Difference high-low
	\$75,000 or higher	\$30,000- 49,999	Under \$30,000	
Elective cosmetic surgery	78%	63%	49%	29
Surgery to prevent having children	89	80	63	26
Skin or lip injections	68	55	40	28
Hair replacement surgery	86	79	68	18
Laser eye surgery	97	92	81	16
Cosmetic dentistry to improve smile	94	87	79	15
	---Education---			Difference
	College grad+	Some college	H.S. or less	
Elective cosmetic surgery	75	65	49	26
Surgery to prevent having children	86	79	65	21
Skin or lip injections	66	55	40	26
Hair replacement surgery	85	81	66	19
Laser eye surgery	95	92	81	14
Cosmetic dentistry to improve smile	92	86	80	12

Note: Respondents who gave other responses or who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

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¹⁴ For an update on upper, middle and higher income levels in the U.S. see Pew Research Center's May 2016 report, "[America's Shrinking Middle Class: A Close Look at Changes Within Metropolitan Areas.](#)"

Most Americans say cosmetic surgery is appropriate, but few see it as having more benefits than downsides for society

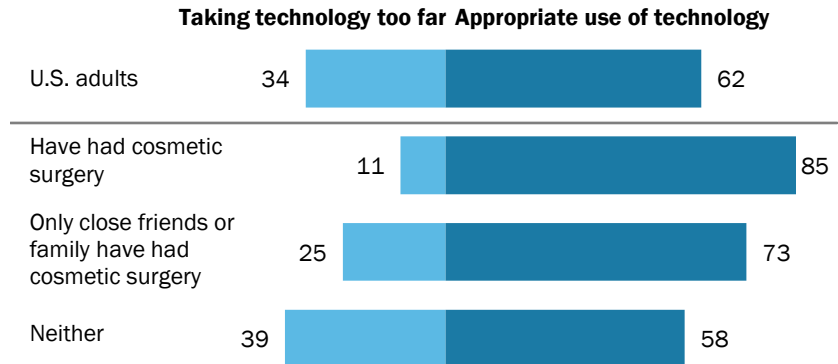
In focus group discussions with people around the country, some respondents talked about the similarity between the kinds of enhancements that may be available in the future and cosmetic surgery that is common now. Some [focus group discussions](#) argued that both future human enhancements and cosmetic surgery were unnecessary and reflective of human vanity.

When asked specifically about cosmetic surgery, a majority of Americans (62%) say it is an appropriate use of

technology, while about a third (34%) say it takes technology too far. There are sizeable differences on this question depending on personal experiences. An overwhelming majority of those who have had cosmetic surgery themselves (85%) say it is an appropriate use of technology. By contrast, 58% of those who have not had such a procedure and who do not have close friends or family who have had one say it is an appropriate use of technology, while 39% of this group says this is taking technology too far.

Most say cosmetic surgery is an appropriate use of technology, especially those who have had it

% of U.S. adults who say elective cosmetic surgery is...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

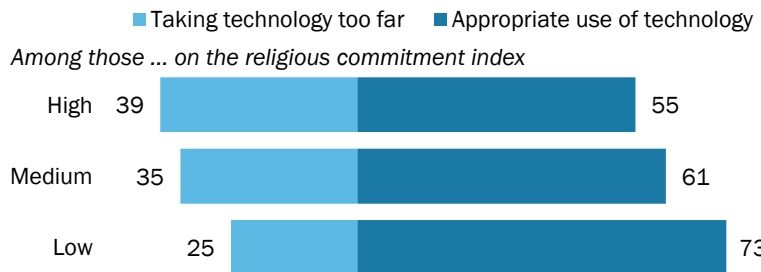
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Those with lower levels of religious commitment are most inclined to say cosmetic surgery is an appropriate use of technology (73%). Among those who are highly religious, 55% say cosmetic surgery is appropriate and 39% say it takes technology too far.

Those lower in religious commitment most likely to see cosmetic surgery as appropriate use of technology

% of U.S. adults in each group who say elective cosmetic surgery is...



Note: Respondents who did not give an answer are not shown. See Methodology for details on index of religious commitment.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

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Majorities of most major religious groups say cosmetic surgery is an appropriate use of technology. Black Protestants and Hispanic Catholics are more closely divided on this issue, as are blacks and Hispanics overall.

Most religious groups say cosmetic surgery is appropriate use of technology; blacks and Hispanics are more divided

% of U.S. adults who say elective cosmetic surgery is ...

	An appropriate use of technology	Taking technology too far
U.S. adults	62%	34%
Religious affiliation		
Protestant	58	36
<i>White evangelical</i>	60	36
<i>White mainline</i>	65	31
<i>Black Protestant</i>	46	46
Catholic	59	38
<i>White Catholic</i>	65	32
<i>Hispanic Catholic</i>	48	47
Unaffiliated	68	30
<i>Atheist</i>	77	23
<i>Agnostic</i>	73	24
<i>Nothing in particular</i>	64	33
Race/ethnicity		
White	67	30
Black	49	43
Hispanic	49	46

Note: Respondents who did not give an answer are not shown. Whites and blacks include only non-Hispanics; Hispanics are of any race.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

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The general public appears somewhat skeptical about the psychological benefits of cosmetic surgery. About a quarter of Americans (26%) say cosmetic surgery “almost always” makes people feel more confident and better about themselves, but a majority (56%) say this only occurs “some of the time.”

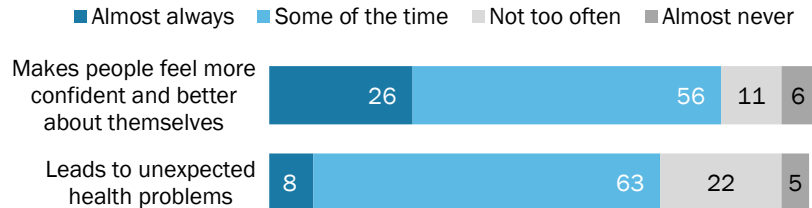
About half of those who have had elective cosmetic surgery (53%) say it almost always makes people feel more

confident and better about themselves. Fewer among those without such personal experience say the same, including 35% of those who have close friends or family who have had elective cosmetic surgery and 23% of those with neither type of personal connection to a cosmetic procedure.

On the other hand, just 8% of U.S. adults say cosmetic surgery “almost always” leads to unexpected health problems. Most (63%) say this sometimes occurs. Those who have had elective cosmetic surgery are less likely than others to say unexpected health problems occur at least some of the time.

More Americans say cosmetic surgery has positive psychological benefits than say it has negative health effects

% of U.S. adults who say elective cosmetic surgery ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

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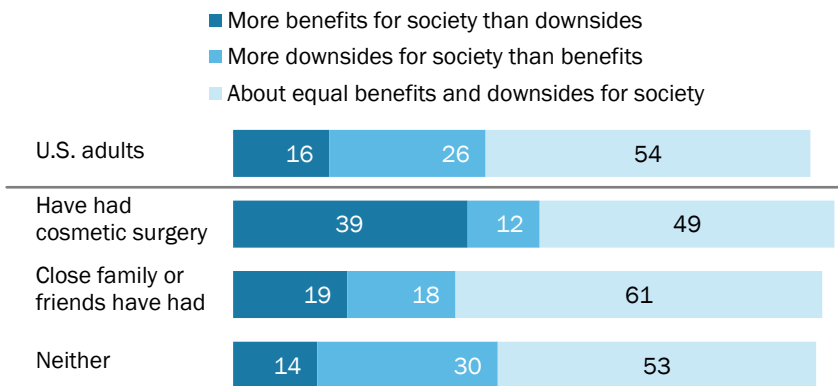
Overall, about half of Americans (54%) say elective cosmetic surgery leads to both benefits and downsides for society, with a smaller share (26%) expressing the belief that there are more downsides than benefits. Relatively few (16%) say there are more benefits than downsides.

Again, those who have had elective cosmetic surgery are more likely to express positive views about it. 39% of people in this group say cosmetic surgery has more benefits than downsides for society, while just 12% say it has more downsides. But like the general population, about half (49%) say the benefits and downsides for society are roughly equal.

Religious commitment and affiliation do not have a significant effect on views of overall benefits and downsides of cosmetic surgery for society.

Most adults see cosmetic surgery as having both benefits and downsides for society

% of U.S. adults who say elective cosmetic surgery leads to ...



Note: Respondents who did not give an answer are not shown.

Source: Survey of U.S. adults conducted April 5-May 2, 2016.

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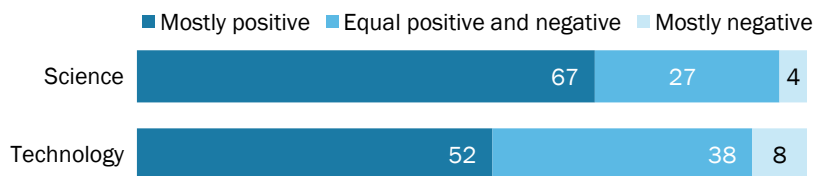
6. Public sees science and technology as net positives for society

The possibilities for human enhancement stem from new scientific and technological innovations. And even though many Americans have reservations about the potential use of cutting-edge biomedical developments considered in earlier chapters, large shares say they think of science and technology, writ large, as mostly beneficial forces in American society.

Two-thirds of U.S. adults (67%) say science has had mostly positive effects on society, while 27% say there have been roughly equal positive and negative effects and just 4% say the effects have been largely negative. This finding is in line with a 2014 [Pew Research Center study](#) and others showing generally positive views about the effect of science on society.

Americans see science and technology as net positives for society

% of U.S. adults who say the effect of _____ on our society has been...



Note: Respondents who did not give an answer are not shown. Each question asked of a randomly selected half of respondents.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

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Overall, views about the effects of technology are also largely positive, if a bit less so in comparison with science. About half of adults (52%) say technology has had mostly positive effects, compared with 38% who say there have been an equal mix of positive and negative effects of technology. Just 8% say technology has had mostly negative effects.

Many Americans see science as having positive effects from health and medicine

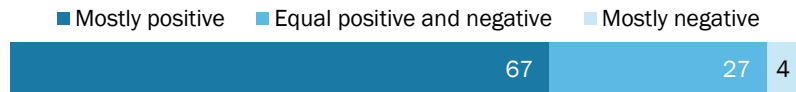
The survey asked an open-ended question to give respondents a chance to explain, in their own words, why they feel the way they do about science's effect on society. Some 67% of Americans say science has had a mostly positive effect on society; the most common reasons cited are related to medicine and health (59% of this group), including improvements in medical research, quality and longevity of life, and treatment of disease.

Other ways science is seen to benefit society include overall knowledge and reasoning skills (19%), technology improvements (15%) and environmental benefits and awareness about environmental issues (14%).

Just 4% of adults say the effect of science has been primarily negative. This group of 60 survey respondents is not large enough to analyze separately.

Most Americans think science has had a positive effect on society, especially from medicine, health

% of U.S. adults who say science has had a _____ effect on society



What ways has science had a positive effect on society?

Among the 67% of U.S. adults who say science has had a mostly positive effect on society, % who cite the following reasons

Medicine/health	59%
Knowledge/reasoning skills	19
Technology/computerization	15
Environment and environmental awareness	14
Positive effect on life and society	14
Products and inventions	7
Food	6
Communication	5
Transportation/infrastructure/engineering	5
Space	4
Genes	1
Research (general)	1
Safety (general)	1
Confirming creationism/Bible teachings	<1
Military defense/strength	<1
Entertainment	<1
Commerce	<1
Depends on the way it is used	<1
General positive	3
Mentions of negative effects (e.g., climate warming)	<1
Other/indecipherable	<1
Don't know/not sure	11

Note: Based on those who say science has had a mostly positive effect on society. Verbatim responses are coded into categories; several figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

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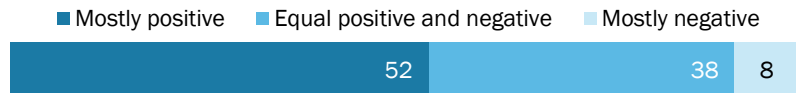
Technology seen as positive, especially for quickly and easily sharing information

Overall, 52% of U.S. adults say the effect of technology has been largely positive. Within this group, 57% cite the vast network of information and communication that is available, easily accessed and shared across the world as a benefit for society. Another 21% see improvements to health, medicine and medical research as benefits of technology.

Other ways technology is seen to have a positive effect on society include increased knowledge and understanding, improvements in industry and jobs and an interconnectedness of the world as a result of globalization.

About half of Americans think technology has had a mostly positive effect on society; especially from easy access and speed of information

% of U.S. adults who say technology has had a _____ effect on society



What ways has technology had a positive effect on society?

Among the 52% of U.S. adults who say technology has had a mostly positive effect on society, % who cite the following reasons

Information access and sharing, ease, speed and convenience of information	57%
Health/medicine	21
Improvements in industry and work	11
Increased knowledge/curiosity/understanding	10
Access and speed of media	8
Makes life/tasks easier	7
Interconnectedness of the world/globalization	7
Science/scientific advancements	6
References to specific devices/internet	6
Transportation and infrastructure	5
Improvements in goods	3
Safety	3
Understanding of government/increased accountability	1
Helping us progress by doing what we can't/extension of human limits	1
Learning what isn't taught in school	<1
General positive	3
Mentions of negative effects (e.g., misuse of information, safety issues, tasks)	<1
Other/indecipherable	2
Don't know/not sure	11

Note: Based on those who say technology has had a mostly positive effect on society. Verbatim responses are coded into categories; several figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

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Just 8% of Americans say technology has mostly had negative effects on society. The leading reason for this perspective is the feeling that technology has led to a breakdown of communication and human interaction (41% of this group). Another 28% say technology has degraded society's morals and values, leading to a reliance on instant gratification and promoting negativity. Others complain that technology has led to an inability to handle normal tasks (20%) or to the misuse of widely available information (16%).

Those who say technology has negative effects cite loss of interpersonal communication

Among the 8% of U.S. adults who say technology has had a mostly negative effect on society, % who cite the following reasons

Loss of ability to communicate, interact	41%
Degrades morals and values, promotes negativity	28
Inability to handle normal tasks because of dependence on devices	20
Misuse of information	16
References to specific devices/Internet	14
Safety issues (e.g., texting and driving)	6
Health problems	3
Pollution, environmental degradation	1
General negative	3
Positive effects (e.g., health/medicine)	1
Other/indecipherable	3
Don't know/not sure	7

Note: Based on those who say technology has had a mostly negative effect on society. Verbatim responses are coded into categories; several figures in the table are based on combining related codes into NET categories. Figures add to more than 100% because multiple responses were allowed.

Source: Survey of U.S. adults conducted March 2-28, 2016.

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About this report

This report is one in an occasional series on the social and ethical implications of forward-looking biomedical developments. For research on a related idea see “[Living to 120 and Beyond: Americans Views on Aging, Medical Advances and Radical Life Extension.](#)”

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Methodology

This report is drawn from two surveys conducted as part of the American Trends Panel (ATP), created by Pew Research Center, a nationally representative panel of randomly selected U.S. adults living in households. Respondents who self-identify as internet users and who provided an email address participate in the panel via monthly self-administered web surveys, and those who do not use the internet or decline to provide an email address participate via the mail. The panel is being managed by Abt SRBI.

Data in this report are drawn primarily from the March wave of the panel, conducted March 2-28, 2016, among 4,726 respondents (4,243 by web and 483 by mail). The margin of sampling error for the full sample of 4,726 respondents from the March wave is plus or minus 2.2 percentage points.

Members of the American Trends Panel were recruited from two large, national landline and cellphone random-digit dial (RDD) surveys conducted in English and Spanish. At the end of each survey, respondents were invited to join the panel. The first group of panelists were recruited from the 2014 Political Polarization and Typology Survey, conducted Jan. 23 to March 16, 2014. Of the 10,013 adults interviewed, 9,809 were invited to take part in

Margins of error

	Sample size	Margin of error in percentage points
All U.S. adults	4,726	+/- 2.2
<i>Religious affiliation</i>		
Protestant NET	2,153	+/- 3.3
<i>White evangelical</i>	833	+/- 5.3
<i>White mainline</i>	708	+/- 5.7
<i>Black Protestant</i>	289	+/- 8.9
Catholic NET	859	+/- 5.2
<i>White Catholic</i>	634	+/- 6.0
<i>Hispanic Catholic</i>	160	+/- 12.0
Unaffiliated NET	1,185	+/- 4.4
<i>Atheist</i>	277	+/- 9.1
<i>Agnostic</i>	303	+/- 8.7
<i>Nothing in particular</i>	605	+/- 6.2
<i>Religious commitment</i>		
High	1,205	+/- 4.4
Medium	2,390	+/- 3.1
Low	1,024	+/- 4.7
<i>Race/ethnicity</i>		
White, not Hispanic	3,605	+/- 2.5
Black, not Hispanic	406	+/- 7.5
Hispanic	378	+/- 7.8

Note: The margins of error are reported at the 95% level of confidence and are calculated by taking into account the average design effect for each subgroup.

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the panel and a total of 5,338 agreed to participate.¹⁵ The second group of panelists were recruited from the 2015 Survey on Government, conducted Aug. 27 to Oct. 4, 2015. Of the 6,004 adults interviewed, all were invited to join the panel, and 2,976 agreed to participate.¹⁶

Participating panelists provided either a mailing address or an email address to which a welcome packet, a monetary incentive and future survey invitations could be sent. Panelists also receive a small monetary incentive after participating in each wave of the survey.

The ATP data were weighted in a multistep process that begins with a base weight incorporating the respondents' original survey selection probability and the fact that in 2014 some panelists were subsampled for invitation to the panel. Next, an adjustment was made for the fact that the propensity to join the panel and remain an active panelist varied across different groups in the sample. The final step in the weighting uses an iterative technique that matches gender, age, education, race, Hispanic origin and region to parameters from the U.S. Census Bureau's 2014 American Community Survey. Population density is weighted to match the 2010 U.S. Decennial Census.

Telephone service is weighted to estimates of telephone coverage for 2016 that were projected from the January-June 2015 National Health Interview Survey. Volunteerism is weighted to match the 2013 Current Population Survey

Margins of error continued

	Sample size	Margin of error in percentage points
All adults	4,726	+/- 2.2
Men	2,313	+/- 3.2
Women	2,413	+/- 3.1
18-29	608	+/- 6.2
30-49	1,322	+/- 4.2
50-64	1,492	+/- 3.9
65 and older	1,300	+/- 4.2
Postgraduate degree	1,083	+/- 4.6
Bachelor's degree only	1,259	+/- 4.3
Some college	1,522	+/- 3.9
H.S. graduate or less	862	+/- 5.2
<i>Family income</i>		
\$150,000 or more	508	+/- 6.7
\$100,000-\$149,999	673	+/- 5.9
\$75,000-\$99,999	654	+/- 5.9
\$50,000-\$74,999	782	+/- 5.4
\$30,000-\$49,999	870	+/- 5.1
Under \$30,000	1,155	+/- 4.5

Note: The margins of error are reported at the 95% level of confidence and are calculated by taking into account the average design effect for each subgroup.

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¹⁵ When data collection for the 2014 Political Polarization and Typology Survey began, non-internet users were subsampled at a rate of 25%, but a decision was made shortly thereafter to invite all non-internet users to join. In total, 83% of non-internet users were invited to join the panel.

¹⁶ Respondents to the 2014 Political Polarization and Typology Survey who indicated that they are internet users but refused to provide an email address were initially permitted to participate in the American Trends Panel by mail, but were no longer permitted to join the panel after Feb. 6, 2014. Internet users from the 2015 Survey on Government who refused to provide an email address were not permitted to join the panel.

Volunteer Supplement. Internet access is adjusted using a measure from the 2015 Survey on Government. Frequency of internet use is weighted to an estimate of daily internet use projected to 2016 from the 2013 Current Population Survey Computer and Internet Use Supplement. It also adjusts for party affiliation using an average of the three most recent Pew Research Center general public telephone surveys. Sampling errors and statistical tests of significance take into account the effect of weighting. Interviews are conducted in both English and Spanish, but the Hispanic sample in the American Trends Panel is predominantly native born and English speaking.

The margins of error tables show the unweighted sample sizes and the error attributable to sampling that would be expected at the 95% level of confidence for different groups in the survey. Sample sizes and sampling errors for other subgroups are available upon request.

In addition to sampling error, one should bear in mind that question wording and practical difficulties in conducting surveys can introduce error or bias into the findings of opinion polls.

The web component of the March wave had a response rate of 68% (4,243 responses among 6,267 web-based individuals in the panel); the mail component had a response rate of 68% (483 responses among 710 non-web individuals in the panel). Taking account of the combined, weighted response rate for the recruitment surveys (10.0%) and attrition from panel members who were removed at their request or for inactivity, the cumulative response rate for the March ATP wave is 3%.¹⁷

Additional survey data

Some data in this report are also drawn from the April wave of the same panel, conducted April 5-May 2, 2016 among 4,685 respondents (4,207 by web and 478 by mail). The margin of sampling error for the full sample of 4,685 respondents from the April wave is plus or minus 2.2 percentage points. Sample sizes and sampling errors for subgroups in this wave are available upon request.

The web component of the April wave had a response rate of 83% (4,207 responses among 5,091 web-based individuals in the panel); the mail component had a response rate of 77% (478 responses among 625 non-web individuals in the panel). Taking account of the combined, weighted response rate for the recruitment surveys (10.0%) and attrition from panel members who

¹⁷ Approximately once per year, panelists who have not participated in multiple consecutive waves are removed from the panel. These cases are counted in the denominator of cumulative response rates.

were removed at their request or for inactivity, the cumulative response rate for the April ATP wave is 3%.¹⁸

Questionnaire development and testing

Pew Research Center developed the questionnaire for this study. The design of the questionnaire was informed by the results of six focus groups and additional pretests with a non-probability sample, as well as input from Pew Research Center staff and six external advisers on the project.

Focus groups. Pew Research Center conducted a series of six focus groups around the country from Jan. 19-Feb. 4, 2016, designed to gain insight into Americans' reasoning about the possibility of human enhancements. The groups focused on longer versions of the three scenarios that were presented in the national adult survey: gene editing to reduce disease risk, brain chip implants to improve cognitive abilities and synthetic blood substitutes to improve physical abilities. This is not an exhaustive list of potential human enhancements. The focus group discussions focused on the kinds of moral and practical considerations people bring to bear in thinking about these issues. The focus group moderators asked participants to consider the potential use of these enhancements for healthy people, not those who are sick or in need. See "[American Voices on Ways Human Enhancement Could Shape Our Future](#)" for further details on the focus groups.

Pilot testing questions. Pew Research Center conducted 17 online, nonprobability surveys to test question wording options for the questionnaire. These pilot tests were also used to test the information presented about each of the three types of human enhancement. The pilot tests were completed from January through February, 2016. Each survey had an average of 100 respondents, ages 18 and older, and was conducted entirely online. Each individual pilot test covered a single type human enhancement (e.g., gene editing) and covered only a short set of about 10 questions.

Outside advisers. Pew Research Center also consulted with a number of expert advisers, listed in the acknowledgements section above, to inform the development of the questionnaire, including the scenarios or vignettes describing each type of human enhancement. We are grateful to this group for their input, but Pew Research Center bears full responsibility for the questionnaire design and analysis.

Religious commitment index

Survey respondents were classified into high, medium and low levels of religious commitment based on three indicators: frequency of religious service attendance, self-reported importance of

¹⁸ Approximately once per year, panelists who have not participated in multiple consecutive waves are removed from the panel. These cases are counted in the denominator of cumulative response rates.

religion in their lives and frequency of prayer. Those who attend worship services at least weekly, pray at least once a day and say religion is very important in their lives are classified as high in religious commitment. Those low in commitment say religion is not too or not at all important in their lives, that they seldom or never attend worship services and seldom or never pray. All others are classified as exhibiting a medium level of religious commitment.

Survey questionnaire and topline

2016 PEW RESEARCH CENTER'S AMERICAN TRENDS PANEL

March 2-28, 2016

TOTAL N=4,726

WEB RESPONDENTS N=4,243

MAIL RESPONDENTS N=483¹⁹

ASK FORM 1 [N=2,410]:

SC1 Overall, would you say science has had a mostly positive effect on our society or a mostly negative effect on our society?

Mar 2-Mar 28

2016

67	Mostly positive
4	Mostly negative
27	Equal positive and negative effects
2	No answer

ASK IF "MOSTLY POSITIVE" (SC1=1) [N=1,835]:

SC1POS What are the main ways you think science has had a positive effect on society?

BASED ON (THOSE WHO SAID "MOSTLY POSITIVE") N=1,835

Mar 2-Mar 28

2016

59	Medicine/Health NET
19	Knowledge/Reasoning NET
15	Technology & Computerization NET
14	Environment and environmental awareness NET
14	Positive effect on life and society NET
7	Products and inventions NET
6	Food NET
5	Communication
5	Transportation/Infrastructure/Engineering NET
4	Space
1	Genes NET
1	Research (general)
1	Safety (general)
*	Confirming creationism/bible teachings
*	Military defense/strength
*	Entertainment
*	Commerce
*	Depends on the way it's used
*	Science over government
3	General positive
*	Mentions of negative effects (environment, warming)
*	Other/Indecipherable
11	Don't know/Not sure

¹⁹

Question wording in this topline is that from the web version of the survey. Question wording and format was adapted for the paper questionnaire delivered by mail; this questionnaire is available on request. All questions asked in both modes unless noted.

ASK IF "MOSTLY NEGATIVE" (SC1=2):

SC1POS What are the main ways you think science has had a negative effect on society?

THOSE SAYING "MOSTLY NEGATIVE" N = 60
OPEN-END; RESPONSES NOT SHOWN DUE TO SMALL SAMPLE SIZE

ASK FORM 2 :

TECH1 Overall, would you say technology has had a mostly positive effect on our society or a mostly negative effect on our society?

Mar 2-Mar 28

2016

N=2,316

52	Mostly positive
8	Mostly negative
38	Equal positive and negative effects
2	No answer

ASK IF "MOSTLY POSITIVE" (TECH1=1) [N=1,332]:

TECH1POS What are the main ways you think technology has had a positive effect on society?

BASED ON (THOSE WHO SAID "MOSTLY POSITIVE") N=1,332

Mar 2-Mar 28

2016

57	Information access and sharing, ease, speed, and convenience of information NET
21	Health/Medicine NET
11	Improvements in industry and work NET
10	Increased knowledge/curiosity/understanding NET
8	Access and speed of media NET
7	Makes life/tasks easier NET
7	Interconnectedness of the world/globalization NET
6	Science/scientific advancements NET
6	References to specific devices/Internet NET
5	Transportation and infrastructure NET
3	Improvements in goods NET
3	Safety NET
1	Understanding of government/increased accountability
1	Helping us progress by doing what we can't/extension of human limits
*	Learning what isn't taught in school, working to change these issues
3	General positive
*	Mentions of negative effects (misuse of information, safety issues, tasks) NET
2	Other/Indecipherable
11	Don't know/Not sure

ASK IF “MOSTLY NEGATIVE” (TECH1=2) [N=132]:

TECH1NEG What are the main ways you think technology has had a negative effect on society?

BASED ON (THOSE WHO SAID “MOSTLY NEGATIVE”) N=132

Mar 2-Mar 28

2016

41	Loss of ability to communicate, interact NET
28	Degrades morals and values, promotes negativity NET
20	Inability to handle normal tasks because of dependence on devices NET
16	Misuse of information NET
14	References to specific devices/Internet NET
6	Safety issues (texting and driving)
3	Health problems
1	Pollution, environmental degradation
3	General negative
1	Mentions of positive effects (health/medicine)
3	Other/Indecipherable
7	Don't know/Not sure

OTHER QUESTIONS PREVIOUSLY RELEASED OR HELD FOR SEPARATE RELEASE.**ASK ALL:**FUTURE Do you think each of the following things will or will not happen in the next 50 years, that is before the year 2066? **[RANDOMIZE ITEMS]***a. There will be cures for most forms of cancer*

Mar 2-Mar 28

2016

14	Will definitely happen
52	Will probably happen
28	Will probably NOT happen
5	Will definitely NOT happen
1	No answer

b. Computer chips will be routinely embedded in our bodies

Mar 2-Mar 28

2016

11	Will definitely happen
43	Will probably happen
35	Will probably NOT happen
10	Will definitely NOT happen
1	No answer

c. We will routinely use implanted sensors to monitor and adjust all food and medications that enter our bloodstream

Mar 2-Mar 28

2016

8	Will definitely happen
40	Will probably happen
43	Will probably NOT happen
7	Will definitely NOT happen
1	No answer

FUTURE continued...

d. We will eliminate almost all birth defects by manipulating the genes of embryos before a baby is born

Mar 2-Mar 28

2016

7	Will definitely happen
40	Will probably happen
44	Will probably NOT happen
9	Will definitely NOT happen
1	No answer

e. People needing a replacement organ, such as a heart, lung or kidney, will routinely receive a transplant with an artificially-made organ

Mar 2-Mar 28

2016

18	Will definitely happen
64	Will probably happen
16	Will probably NOT happen
2	Will definitely NOT happen
1	No answer

OTHER QUESTIONS PREVIOUSLY RELEASED OR HELD FOR SEPARATE RELEASE.**RANDOMIZE ORDER OF THE THREE SECTIONS: VIGNETTE 1, 2 and 3**

Next, we will show you a short paragraph followed by a series of questions. This is for a separate research effort, unrelated to the earlier questions in this survey.

[RANDOMIZE VIGNETTE 1, 2, 3 ORDER]**ASK ALL:**

New developments in understanding the brain are creating the possibility that doctors will be able to surgically implant a small computer chip in the brain. Right now, these implanted devices are being developed for people with some kind of illness or disability. But in the future, these implanted devices could potentially be available for use by HEALTHY individuals, giving people a much improved ability to concentrate and process information in everyday life.

ASK ALL:

CHIP1 How much have you heard or read about this idea before today?

Mar 2-Mar 28

2016

6	A lot
32	A little
61	Not at all
2	No answer

ASK ALL:

CHIP2

In general, do you think an implanted device giving HEALTHY people a much improved ability to concentrate and process information is something that you, personally, would want or not something you would want?

Mar 2-Mar 28

2016

10	Yes, I would definitely want this
23	Yes, I would probably want this
32	No, I would probably NOT want this
33	No, I would definitely NOT want this
2	No answer

ASK ALL:

CHIP3

Would you say MOST PEOPLE would want or would not want this implanted device?

Mar 2-Mar 28

2016

36	Yes, most people would want this
61	No, most people would NOT want this
4	No answer

ASK ALL:

CHIP4

Thinking about the possibility of an implanted device giving HEALTHY people a much improved ability to concentrate and process information...

a. How ENTHUSIASTIC are you, if at all, about this possibility for society as a whole?

Mar 2-Mar 28

2016

9	Very enthusiastic
25	Somewhat enthusiastic
33	Not too enthusiastic
31	Not at all enthusiastic
2	No answer

b. How WORRIED are you, if at all, about this possibility for society as a whole?

Mar 2-Mar 28

2016

28	Very worried
41	Somewhat worried
21	Not too worried
8	Not at all worried
2	No answer

ASK ALL:

Thinking about the possibility of an implanted device giving HEALTHY people a much improved ability to concentrate and process information...

CHIP5 Which of these statements comes closer to your view, even if neither is exactly right?

Mar 2-Mar 28

2016

46	As humans, we are always trying to better ourselves and this idea is no different
51	This idea is meddling with nature and crosses a line we should not cross
3	No answer

ASK ALL:

CHIP6

If an implanted device becomes available, giving HEALTHY people a much improved ability to concentrate and process information, do you think the following are likely or not likely to happen as a result? [**RANDOMIZE ITEMS**]

	<u>Yes, likely</u>	<u>No, not likely</u>	<u>No answer</u>
a. People who have these implanted devices will be more productive at their jobs			
Mar 2-Mar 28, 2016	55	41	5
b. People who have these implanted devices will feel superior to people who do not			
Mar 2-Mar 28, 2016	71	26	4
c. This option will be used before we fully understand how it affects people's health			
Mar 2-Mar 28, 2016	74	23	3
d. People who have these implanted devices will feel more confident and better about themselves			
Mar 2-Mar 28, 2016	64	32	4
e. Inequality will increase because this option will be available only for the wealthy			
Mar 2-Mar 28, 2016	73	24	3
f. Widespread use of this option will lead to new innovation and problem-solving in society			
Mar 2-Mar 28, 2016	51	44	4

ASK ALL:

CHIP7 Do you think an implanted device giving HEALTHY people a much improved ability to concentrate and process information is ...

Mar 2-Mar 28

2016

23	Morally acceptable
37	Morally UNacceptable
38	Not sure
3	No answer

ASK IF THIS IS THE FIRST VIGNETTE SERIES FOR THE RESPONDENT:

CHIP7OE Can you explain a little about why you think [an implanted device giving HEALTHY people a much improved ability to concentrate and process information] is morally acceptable, morally unacceptable, or something you are not sure about?

Percent of cases among those saying this is morally acceptable, morally unacceptable, or not sure

[Coded from open end, verbatim responses]

	Among those saying "Morally acceptable" N=352 %	Among those saying "Unacceptable" N=626 %	Among those saying "Not sure" N=662 %
Positive effects of brain chip implants			
Humans are always improving and should be bettering ourselves NET	25	*	3
Should be free choice, up to individual NET	17	3	2
Similar to current enhancements NET	16	*	1
Positive effect on society, health and jobs NET	10	*	2
God gave us the means and brains to innovate	*	*	0
General positive comments	6	0	1
Concerns about brain chip implants			
References to the Bible; changing God's plan NET	1	21	6
Disrupting nature; a line we should not cross NET	0	19	7
Could be controlled/used for bad motives NET	4	17	8
Unnecessary; not needed for healthy people NET	1	13	7
Unfair advantage/would widen the gaps NET	4	10	6
Unintended consequences/side effects NET	1	6	5
Loss of individuality, humanity NET	2	7	3
Negative societal effect NET	5	3	1
Should focus efforts on other issues	0	*	1
Need consent, rules to regulate NET	*	*	*
General negative comments	0	3	2
Need more information, unsure			
Need more information/Conflicted NET	3	1	12
Not a moral issue, not morally unacceptable NET	10	2	6
Depends on conditions/consequences NET	3	1	3
Not a believer	2	0	0
Other/Indecipherable	5	2	4
Don't know/Not sure	20	19	39

ASK ALL:

CHIP8

Would an implanted device giving HEALTHY people a much improved ability to concentrate and process information be more acceptable, less acceptable, or would it make no difference in each of these circumstances?

a. If people could turn on and off the effects

Mar 2-Mar 28

2016

32	More acceptable
16	Less acceptable
49	No difference
3	No answer

b. If the effects were permanent and could not be reversed

Mar 2-Mar 28

2016

8	More acceptable
51	Less acceptable
38	No difference
3	No answer

ASK ALL:

CHIP9

Would you say each of the following is an appropriate use of technology or taking technology too far if the effects were such that those who had these implanted devices were...

a. Always able to concentrate and process information at a level EQUAL TO THEIR OWN PEAK ABILITIES before they had the implanted device

Mar 2-Mar 28

2016

47	An appropriate use of technology
50	Taking technology too far
3	No answer

b. Able to concentrate and process information at a level MUCH BETTER THAN THEIR OWN PEAK ABILITIES before they had the implanted device

Mar 2-Mar 28

2016

39	An appropriate use of technology
57	Taking technology too far
4	No answer

c. Able to concentrate and process information at a level FAR ABOVE THAT OF ANY HUMAN KNOWN-TO-DATE

Mar 2-Mar 28

2016

30	An appropriate use of technology
67	Taking technology too far
3	No answer

ASK ALL:

CHIP10

If these implanted devices become available, giving HEALTHY people a much improved ability to concentrate and process information, how much, if at all, do you think society as a whole would change?

Mar 2-Mar 28

2016

48	A great deal
31	Some
10	Not too much
8	Not at all
3	No answer

ASK ALL:

CHIP11

If these implanted devices become available giving HEALTHY people a much improved ability to concentrate and process information, do you think there would be ...

Mar 2-Mar 28

2016

25	More benefits for society than downsides
41	More downsides for society than benefits
31	About equal benefits and downsides for society
4	No answer

[RANDOMIZE VIGNETTE 1, 2, 3 ORDER]**ASK ALL:**

New developments are creating the possibility of using synthetic blood substitutes to increase the oxygen level in a person's blood stream, giving them increased speed, strength and stamina. Right now, this man-made substitute for blood is being developed for people with some kind of illness or medical condition. But in the future, a transfusion with this kind of synthetic blood substitute could be developed for use by HEALTHY individuals, giving people a much improved ability to complete all sorts of tasks with much greater speed, strength and stamina.

ASK ALL:

STR1

How much have you heard or read about this idea before today?

Mar 2-Mar 28

2016

3	A lot
19	A little
77	Not at all
1	No answer

ASK ALL:

STR2 In general, do you think using a synthetic blood substitute giving HEALTHY people much greater speed, strength and stamina is something that you, personally, would want or not something you would want?

Mar 2-Mar 28

2016

11	Yes, I would definitely want this
24	Yes, I would probably want this
35	No, I would probably NOT want this
28	No, I would definitely NOT want this
2	No answer

ASK ALL:

STR3 Would you say MOST PEOPLE would want or would not want this synthetic blood substitute?

Mar 2-Mar 28

2016

44	Yes, most people would want this
53	No, most people would NOT want this
3	No answer

ASK ALL:

STR4 Thinking about the possibility of this synthetic blood substitute giving HEALTHY people much greater speed, strength and stamina ...

a. How ENTHUSIASTIC are you, if at all, about this possibility for society as a whole?

Mar 2-Mar 28

2016

10	Very enthusiastic
27	Somewhat enthusiastic
34	Not too enthusiastic
27	Not at all enthusiastic
2	No answer

b. How WORRIED are you, if at all, about this possibility for society as a whole?

Mar 2-Mar 28

2016

20	Very worried
42	Somewhat worried
26	Not too worried
9	Not at all worried
2	No answer

ASK ALL:

Thinking about the possibility of this synthetic blood substitute giving HEALTHY people much greater speed, strength and stamina...

STR5 Which of these statements comes closer to your view, even if neither is exactly right?

Mar 2-Mar 28

2016

48	As humans, we are always trying to better ourselves and this idea is no different
49	This idea is meddling with nature and crosses a line we should not cross
3	No answer

ASK ALL:

STR6

If this synthetic blood substitute becomes available giving HEALTHY people much greater speed, strength and stamina, do you think the following are likely or not likely to happen as a result? **[RANDOMIZE ITEMS]**

	<u>Yes, likely</u>	<u>No, not likely</u>	<u>No answer</u>
a. People who have a transfusion with this synthetic blood substitute will be more productive at their jobs Mar 2-Mar 28, 2016	46	51	4
b. People who have a transfusion with this synthetic blood substitute will feel superior to people who do not Mar 2-Mar 28, 2016	63	34	3
c. This option will be used before we fully understand how it affects people's health Mar 2-Mar 28, 2016	73	24	3
d. People who have a transfusion with this synthetic blood substitute will feel more confident and better about themselves Mar 2-Mar 28, 2016	61	35	4
e. Inequality will increase because this option will be available only for the wealthy Mar 2-Mar 28, 2016	70	27	3
f. Widespread use of this option will lead to new innovation and problem solving in society Mar 2-Mar 28, 2016	39	58	3

ASK ALL:

STR7 Do you think having a transfusion with this synthetic blood substitute giving HEALTHY people much greater speed, strength and stamina is ...

Mar 2-Mar 28

2016

22	Morally acceptable
35	Morally UNacceptable
41	Not sure
2	No answer

ASK IF THIS IS THE FIRST VIGNETTE SERIES FOR THE RESPONDENT:

STR7OE Can you explain a little about why you think this is morally acceptable, morally unacceptable, or something you are not sure about?

Percent of cases among those saying this is morally acceptable, morally unacceptable, or not sure

[Coded from open end, verbatim responses]

	Among those saying "Morally acceptable" N=347 %	Among those saying "Unacceptable" N=433 %	Among those saying "Not sure" N=621 %
Positive effects of synthetic blood substitutes			
Humans are always improving and should be bettering ourselves NET	25	*	2
Similar to current enhancements NET	19	9	6
Positive effect on society, health and jobs NET	16	1	3
Should be free choice, up to individual NET	12	*	4
God gave us the means and brains to innovate	3	*	1
General positive comments	5	0	*
Concerns about synthetic blood substitutes			
Disrupting nature; a line we should not cross NET	*	25	7
References to the Bible; changing God's plan NET	3	20	6
Unnecessary; not needed for healthy people NET	3	17	7
Could be controlled/used for bad motives NET	1	10	5
Unfair advantage/would widen the gaps NET	8	10	9
Unintended consequences/side effects NET	3	9	8
Negative societal effect NET	5	6	5
Loss of individuality, humanity NET	1	2	*
Need consent, rules to regulate NET	1	*	2
Should focus efforts on other issues	0	1	*
General negative comments	0	2	1
Need more information, unsure			
Need more information/Conflicted NET	6	1	18
Depends on conditions/consequences NET	4	1	8
Not a moral issue, not morally unacceptable NET	15	2	5
Not a believer	*	0	0
Other/Indecipherable	1	1	1
Don't know/Not sure	11	18	33

ASK ALL:

STR8 Would using a synthetic blood substitute giving HEALTHY people much greater speed, strength and stamina be more acceptable, less acceptable, or would it make no difference in each of these circumstances?

a. If people could turn on and off the effects

Mar 2-Mar 28

2016

28	More acceptable
17	Less acceptable
53	No difference
3	No answer

b. If the effects were permanent and could not be reversed

Mar 2-Mar 28

2016

9	More acceptable
48	Less acceptable
40	No difference
3	No answer

ASK ALL:

STR9 Would you say each of the following is an appropriate use of technology or taking technology too far if the effects were such that those who had this synthetic blood substitute ...

a. Always had speed, strength and stamina at a level EQUAL TO THEIR OWN PEAK ABILITIES before they had a transfusion with this synthetic blood substitute

Mar 2-Mar 28

2016

47	An appropriate use of technology
50	Taking technology too far
3	No answer

b. Had speed, strength and stamina at a level MUCH BETTER THAN THEIR OWN PEAK ABILITIES before they had a transfusion with this synthetic blood substitute

Mar 2-Mar 28

2016

37	An appropriate use of technology
59	Taking technology too far
4	No answer

c. Had speed, strength and stamina at a level FAR ABOVE THAT OF ANY HUMAN KNOWN-TO-DATE

Mar 2-Mar 28

2016

28	An appropriate use of technology
69	Taking technology too far
4	No answer

ASK ALL:

STR10

If this synthetic blood substitute becomes available, giving HEALTHY people much greater speed, strength and stamina, how much, if at all, do you think society as a whole would change?

Mar 2-Mar 28

2016

38	A great deal
38	Some
14	Not too much
8	Not at all
3	No answer

ASK ALL:

STR11

If this synthetic blood substitute becomes available, giving HEALTHY people much greater speed, strength and stamina, do you think there would be ...

Mar 2-Mar 28

2016

22	More benefits for society than downsides
41	More downsides for society than benefits
34	About equal benefits and downsides for society
3	No answer

[RANDOMIZE VIGNETTE 1, 2, 3 ORDER]

New developments in genetics and gene-editing techniques are making it possible to treat some diseases and conditions by modifying a person's genes. In the future, gene-editing techniques could be used for any newborn, by changing the DNA of the embryo before it is born, and giving that baby a much reduced risk of serious diseases and conditions over his or her lifetime. Any changes to a baby's genetic make-up could be passed on to future generations if they later have children, and over the long term this could change the genetic characteristics of the population.

ASK ALL:

GEN1

How much have you heard or read about this idea before today?

Mar 2-Mar 28

2016

9	A lot
48	A little
42	Not at all
1	No answer

ASK ALL:

GEN2 If you had a baby, do you think this gene-editing -- giving a much reduced risk of serious diseases and conditions over his or her lifetime -- is something that you, personally, would want for your baby or not something you would want for your baby?

Mar 2-Mar 28

2016

16	Yes, I would definitely want this for my baby
32	Yes, I would probably want this for my baby
28	No, I would probably NOT want this for my baby
21	No, I would definitely NOT want this for my baby
2	No answer

ASK ALL:

GEN3 Would you say MOST PEOPLE would want or would not want this gene-editing for their baby?

Mar 2-Mar 28

2016

55	Yes, most people would want this for their baby
42	No, most people would NOT want this for their baby
3	No answer

ASK ALL:

GEN4 Thinking about the possibility of this gene-editing giving HEALTHY babies a much reduced risk of serious diseases and conditions...

a. How ENTHUSIASTIC are you, if at all, about this possibility for society as a whole?

Mar 2-Mar 28

2016

15	Very enthusiastic
34	Somewhat enthusiastic
30	Not too enthusiastic
19	Not at all enthusiastic
2	No answer

b. How WORRIED are you, if at all, about this possibility for society as a whole?

Mar 2-Mar 28

2016

22	Very worried
46	Somewhat worried
23	Not too worried
8	Not at all worried
2	No answer

ASK ALL:

Thinking about the possibility of this gene-editing giving HEALTHY babies a much reduced risk of serious diseases and conditions ...

GEN5 Which of these statements comes closer to your view, even if neither is exactly right?
[RANDOMIZE RESPONSE OPTIONS]

Mar 2-Mar 28
2016

51	As humans, we are always trying to better ourselves and this idea is no different.
46	This idea is meddling with nature and crosses a line we should not cross.
3	No answer

ASK ALL:

GEN6 If this gene-editing become available, giving HEALTHY babies a much reduced risk of serious diseases and conditions, do you think the following are likely or not likely to happen as a result? **[RANDOMIZE ITEMS]**

	<u>Yes, likely</u>	<u>No, not likely</u>	<u>No answer</u>
a. People who have this gene-editing will be more productive at their jobs Mar 2-Mar 28, 2016	32	64	4
b. People who have this gene-editing will feel superior to people who do not Mar 2-Mar 28, 2016	53	44	3
c. This option will be used before we fully understand how it affects people's health Mar 2-Mar 28, 2016	73	24	3
d. People who have this gene-editing will feel more confident and better about themselves Mar 2-Mar 28, 2016	52	44	4
e. Inequality will increase because this option will be available only for the wealthy Mar 2-Mar 28, 2016	70	27	3
f. Widespread use of this option will lead to new innovation and problem-solving in society Mar 2-Mar 28, 2016	45	51	3

ASK ALL:

GEN7 Do you think using this gene-editing giving HEALTHY babies a much reduced risk of serious diseases and conditions is ...

Mar 2-Mar 28

2016

28	Morally acceptable
30	Morally UNacceptable
40	Not sure
2	No answer

ASK IF THIS IS THE FIRST VIGNETTE SERIES FOR THE RESPONDENT:

GEN7OE Can you explain a little about why you think [using this gene editing giving HEALTHY babies a much reduce risk of serious diseases and conditions] is morally acceptable, morally unacceptable, or something you are not sure about?

Percent of cases among those saying this is morally acceptable, morally unacceptable, or not sure

[Coded from open end, verbatim responses]

	Among those saying "Morally acceptable" N=475	Among those saying "Unacceptable" N=430	Among those saying "Not sure" N=728
	%	%	%
Positive effects of gene editing			
Humans are always improving and should be bettering ourselves NET	32	1	2
Positive effect on society, health and jobs NET	21	1	4
Similar to current enhancements NET	8	4	2
God gave us the means and brains to innovate	5	0	1
Should be free choice, up to individual NET	4	*	1
General positive comments	3	0	*
Concerns about gene editing			
References to the Bible; changing God's plan NET	1	34	9
Disrupting nature; a line we should not cross NET	3	26	11
Could be controlled/used for bad motives NET	3	9	5
Unintended consequences/side effects NET	4	8	10
Unnecessary; not needed for healthy people NET	8	5	4
Unfair advantage/would widen the gaps NET	5	4	4
Negative societal effect NET	3	4	3
Loss of individuality, humanity NET	*	4	1
Need consent, rules to regulate NET	1	1	2
Should focus efforts on other issues	1	1	*
General negative comments	0	3	2
Need more information, unsure			
Need more information/Conflicted NET	5	2	14
Depends on conditions/consequences NET	4	2	7
Not a moral issue, not morally unacceptable NET	6	*	2
Not a believer	1	*	*
Other/Indecipherable	3	2	1
Don't know/Not sure	11	27	41

ASK ALL:

GEN8

Would this gene-editing giving HEALTHY babies a much reduced risk of serious diseases and conditions be more acceptable, less acceptable, or would it make no difference in each of these circumstances?

a. If people could choose which diseases and conditions are affected

Mar 2-Mar 28

2016

41	More acceptable
17	Less acceptable
39	No difference
3	No answer

b. If the effects were permanent and could not be reversed

Mar 2-Mar 28

2016

19	More acceptable
37	Less acceptable
41	No difference
3	No answer

c. If the effects were limited to that person and NOT passed on to future generations

Mar 2-Mar 28

2016

34	More acceptable
23	Less acceptable
40	No difference
3	No answer

d. If it changed the genetic make-up of the whole population for the foreseeable future

Mar 2-Mar 28

2016

17	More acceptable
49	Less acceptable
31	No difference
3	No answer

e. If it required testing on human embryos in order to develop these techniques

Mar 2-Mar 28

2016

11	More acceptable
54	Less acceptable
32	No difference
3	No answer

ASK ALL:

GEN9

Would you say this is an appropriate use of technology or taking technology too far if the effects were such that those who had this gene-editing were ...

a. Always EQUALLY HEALTHY as the average person today

Mar 2-Mar 28

2016

54	An appropriate use of technology
43	Taking technology too far
3	No answer

b. MUCH HEALTHIER than the average person today

Mar 2-Mar 28

2016

52	An appropriate use of technology
45	Taking technology too far
4	No answer

c. FAR HEALTHIER than any human known-to-date

Mar 2-Mar 28

2016

42	An appropriate use of technology
54	Taking technology too far
4	No answer

ASK ALL:

GEN10

If this gene-editing becomes available, giving HEALTHY babies a much reduced risk of serious diseases and conditions, how much, if at all, do you think society as a whole would change?

Mar 2-Mar 28

2016

46	A great deal
35	Some
10	Not too much
6	Not at all
2	No answer

ASK ALL:

GEN11

If this gene-editing becomes available giving HEALTHY babies a much reduced risk of serious diseases and conditions, do you think there would be ...

Mar 2-Mar 28

2016

36	More benefits for society than downsides
28	More downsides for society than benefits
33	About equal benefits and downsides for society
3	No answer

2016 PEW RESEARCH CENTER'S AMERICAN TRENDS PANEL**April 5–May 2, 2016****TOTAL N=4,685****WEB RESPONDENTS N=4,207****MAIL RESPONDENTS N=478²⁰****ASK ALL:**

HLTHRATE Would you say that in general your health is excellent, very good, good, fair, or poor?

Apr 5-May 2

2016

N=4,685

11	Excellent
32	Very good
37	Good
14	Fair
4	Poor
1	No answer

Jul 7-Aug 4

2014²¹

N=3,351

13
35
32
15
5
*

ASK ALL:

G1 Do you, or does anyone in your immediate family, have a gene that predisposes you to a serious disease such as Alzheimer's, cancer, heart disease, or sickle cell anemia?

Apr 5-May 2

2016

27	Yes
43	No
30	Not sure
1	No answer

ASK ALL:

G2 Have you, or has anyone in your immediate family, ever had a genetic test, or haven't you done this?

Apr 5-May 2

2016

10	Yes
70	No
19	Not sure
1	No answer

OTHER QUESTIONS PREVIOUSLY RELEASED OR HELD FOR SEPARATE RELEASE.

²⁰ Question wording in this topline is that from the web version of the survey. Question wording and format was adapted for the paper questionnaire delivered by mail; this questionnaire is available on request. All questions asked in both modes unless noted.

²¹ In Wave 5 (Jul 7-Aug 4, 2014), 1,494 panelists were surveyed by phone.

On another topic...**ASK ALL:**COS1 Which, if any, of the following have you had done? *[Check all that apply]*

<u>Apr 5-May 2, 2016</u>	<u>Selected</u>	<u>Not selected /No answer</u>
a. Elective cosmetic surgery (such as breast changes, nose reshaping, eyelid surgery, liposuction, tummy tuck, facelift)	4	96
b. Lasik or laser-assisted eye surgery	9	91
c. Surgery to prevent you from having children in the future (such as tubal ligation or vasectomy)	15	85
d. Injections to fill out or smooth your skin or lips (such as collagen, Botox or hyaluronic acid)	2	98
e. Hair replacement surgery	1	99
f. Cosmetic dental procedures to improve your smile	11	89
g. None of these [EXCLUSIVE PUNCH]	66	34

ASK ALL:COS2 Do you have any close friends or family members who have had any of the following? *[Check all that apply]*

<u>Apr 5-May 2, 2016</u>	<u>Selected</u>	<u>Not selected /No answer</u>
a. Elective cosmetic surgery (such as breast changes, nose reshaping, eyelid surgery, liposuction, tummy tuck, facelift)	23	77
b. Lasik or laser-assisted eye surgery	32	68
c. Surgery to prevent you from having children in the future (such as tubal ligation or vasectomy)	33	67
d. Injections to fill out or smooth your skin or lips (such as collagen, Botox or hyaluronic acid)	10	90
e. Hair replacement surgery	3	97
f. Cosmetic dental procedures to improve your smile	23	77
g. None of these [EXCLUSIVE PUNCH]	40	60

ASK ALL:

COS3 Do you think more people getting each of the following these days is an appropriate use of technology or is it taking technology too far?

<u>Apr 5-May 2, 2016</u>	<u>An appropriate use of technology</u>	<u>Taking technology too far</u>	<u>No answer</u>
a. Elective cosmetic surgery	62	34	4
b. Lasik or laser-assisted eye surgery	89	8	3
c. Surgery to prevent you from having children in the future	76	20	4
d. Injections to fill out or smooth your skin or lips	53	43	4
e. Hair replacement surgery	76	19	5
f. Cosmetic dental procedures to improve your smile	86	11	4

ASK ALL:

COS4 Which of these statements comes closer to your own view, even if neither is exactly right?

Apr 5-May 2
2016

61	People are too quick to undergo cosmetic procedures in order to change their appearance in ways that are not really important
36	It's understandable that more people undergo cosmetic procedures these days because it's a competitive world and people who look more attractive tend to have an advantage
3	No answer

ASK ALL:

COS5 How often do you think elective cosmetic surgery makes people feel more confident and better about themselves?

Apr 5-May 2
2016

26	Almost always
56	Some of the time
11	Not too often
6	Almost never
2	No answer

ASK ALL:

COS6 How often do you think elective cosmetic surgery leads to unexpected health problems?

Apr 5-May 2

2016

8	Almost always
63	Some of the time
22	Not too often
5	Almost never
2	No answer

ASK ALL:

COS7 Thinking about elective cosmetic surgery, do you think there are generally...

Apr 5-May 2

2016

16	More benefits for society than downsides
26	More downsides for society than benefits
54	About equal benefits and downsides for society
3	No answer